

FLEX User's Manual

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PREFACE

The purpose of this User's Guide is to provide the user of the FLEX Operating System with the information required to make effective use of the available system commands and utilities. This manual applies to FLEX 9.0 for full size and mini floppy disks. The user should keep this manual close at hand while becoming familiar with the system. It is organized to make it convenient as a quick reference guide, as well as a thorough reference manual.

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FLEX USER'S MANUAL

I. INTRODUCTION

The FLEX™ Operating System is a very versatile and flexible operating system. It provides the user with a powerful set of system commands to control all disk operations directly from the user's terminal. The systems programmer will be delighted with the wide variety of disk access and file management routines available for personal use. Overall, FLEX is one of the most powerful operating systems available today.

The FLEX Operating System is comprised of three parts, the File Management System (FMS), the Disk Operating System (DOS), and the Utility Command Set (UCS). Part of the power of the overall system lies in the fact that the system can be greatly expanded by simply adding additional utility commands. The user should expect to see many more utilities available for FLEX in the future. Some of the other important features include: fully dynamic file space allocation, the automatic "removal" of defective sectors from the disk, automatic space compression and expansion on all text files, complete user environment control using the TTYSET utility command, and uniform disk wear due to the high performance dynamic space allocator.

The UCS currently contains many very useful commands. These programs reside on the system disk and are only loaded into memory when needed. This means that the set of commands can be easily extended at any time, without the necessity of replacing the entire operating system. The utilities provided with FLEX perform such tasks as the saving, loading, copying, renaming, deleting, appending, and listing of disk files. There is an extensive CATalog command for examining the disk's file directory. Several environment control commands are also provided. Overall, FLEX provides all of the necessary tools for the user's interaction with the disk.

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II. SYSTEM REQUIREMENTS

FLEX requires random access memory from location 0000 through location 2FFF hex (12K). Memory is also required from C000 (48K) through DFFF hex (56K), where the actual operating system resides. The system also assumes at least 2 disk drives are connected to the controller and that they are configured as drives #0 and #1. You should consult the disk drive instructions for this information. FLEX interfaces with the disk controller through a section of driver routines and with the operator console or terminal through a section of terminal I/O routines.

III. GETTING THE SYSTEM STARTED

Each FLEX system diskette contains a binary loader for loading the operating system into RAM. There needs to be some way of getting the loader off of the disk so it can do its work. This can be done by either hand entering the bootstrap loader provided with the disk system, or by using the boot provided in ROM if appropriate to FLEX.

As a specific example, suppose the system we are using has SWTPC's S-BUG installed and we wish to run FLEX. The first step is to power on all equipment and make sure the S-BUG prompt is present (>). Next insert the system diskette into drive 0 (the boot must be performed with the disk in drive 0) and close the door on the drive. Type "D" on the terminal if using a full size floppy system or "U" if a minifloppy system. The disk motors should start, and after about 2 seconds, the following should be displayed on the terminal.

```
FLEX X.X  
DATE (MM,DD,YY)?
```

```
+++
```

The name FLEX identifies the operating system and the X.X will be the version number of the operating system. At this time the current date should be entered, such as 7,3,79. The FLEX prompt is the three plus signs (+++), and will always be present when the system is ready to accept an operator command. The '+++' should become a familiar sight and signifies that FLEX is ready to work for you!

IV. DISK FILES AND THEIR NAMES

All disk files are stored in the form of 'sectors' on the disk and in this version, each sector contains 256 'bytes' of information. Each byte can contain one character of text or one byte of binary machine information. A maximum of 340 user-accessible sectors will fit on a single-sided mini disk or 1140 sectors on a single-sided full size floppy. Double-sided disks would hold exactly twice that number of sectors. Double-density systems will hold more still. The user, however, need not keep count, for the system does this automatically. A file will always be at least one sector long and can have as many as the maximum number of sectors on the disk. The user should not be concerned with the actual placement of the files on the disk since this is done by the operating system. File deletion is also supported and all previously used sectors become immediately available again after a file has been deleted.

All files on the disk have a name. Names such as the following are typical:

```
PAYROLL  
INVNTORY  
TEST1234  
APRIL-78  
WKLY-PAY
```

Anytime a file is created, referenced, or deleted, its name must be used. Names can be most anything but must begin with a letter (not numbers or symbols) and be followed by at most 7 additional characters, called 'name characters'. These 'name characters' can be any combination of the letters 'A' through 'Z' or 'a' through 'z', any digit '0' through '9', or one of the two special characters, the hyphen (-) or the underscore '_', (a left arrow on some terminals).

File names must also contain an 'extension'. The file extension further defines the file and usually indicates the type of information contained therein. Examples of extensions are: TXT for text type files, BIN for machine readable binary encoded files, CMD for utility command files, and BAS for BASIC source programs. Extensions may contain up to 3 'name characters' with the first character being a letter. Most of the FLEX commands assume a default extension on the file name and the user need not be concerned with the actual extension on the file. The user may at anytime assign new extensions, overriding the default value, and treat the extension as just part of the file name. Some examples of file names with their extensions follow:

```
APPEND.CMD  
LEDGER.BAS  
TEST.BIN
```

Note that the extension is always separated from the name by a period '.'. The period is the name 'field separator'. It tells FLEX to treat the following characters as a new field in the name specification.

A file name can be further refined. The name and extension uniquely define a file on a particular drive, but the same name may exist on several drives simultaneously. To designate a particular drive a 'drive number' is added to the file specification. It consists of a single digit (0-3) and is separated from the name by the field separator '.'. The drive number may appear either before the name or after it (after the extension if it is given). If the drive is not specified, the system will default to either the 'system' drive or the 'working' drive. These terms will be described a little later.

Some examples of file specifications with drive numbers follow:

```
0.BASIC
MONDAY.2
1.TEST.BIN
LIST.CMD.1
```

In summary, a file specification may contain up to three fields separated by the field separator. These fields are; 'drive', 'name', and 'extension'. The rules for the file specification can be stated quite concisely using the following notation:

```
[<drive>.]<name>[.<extension>]
or
<name>[.<extension>][.<drive>]
```

The '<>' enclose a field and do not actually appear in the specification, and the '[]' surround optional items of the specification. The following are all syntactically correct:

```
0.NAME.EXT
NAME.EXT.0
NAME.EXT
0.NAME
NAME.0
NAME
```

Note that the only required field is the actual 'name' itself and the other values will usually default to predetermined values. Studying the above examples will clarify the notation used. The same notation will occur regularly throughout the manual.

V. ENTERING COMMANDS

When FLEX is displaying '+++', the system is ready to accept a command line. A command line is usually a name followed by certain parameters depending on the command being executed. There is no 'RUN' command in FLEX. The first file name on a command line is always loaded into memory and execution is attempted. If no extension is given with the file name, 'CMD' is the default. If an extension is specified, the one entered is the one used. Some examples of commands and how they would look on the terminal follow:

```
+++TTYSET
+++TTYSET.CMD
+++LOOKUP.BIN
```

The first two lines are identical to FLEX since the first would default to an extension of CMD. The third line would load the binary file 'LOOKUP.BIN' into memory and, assuming the file contained a transfer address, the program would be executed. A transfer address tells the program loader where to start the program executing after it has been loaded. If you try to load and execute a program in the above manner and no transfer address is present, the message, 'NO LINK' will be output to the terminal, where 'link' refers to the transfer address. Some other error messages which can occur are 'WHAT?' if an illegal file specification has been typed as the first part of a command line, and 'NOT THERE' if the file typed does not exist on the disk.

During the typing of a command line, the system simply accepts all characters until a 'RETURN' key is typed. Any time before typing the RETURN key, the user may use one of two special characters to correct any mistyped characters. One of these characters is the 'back space' and allows deletion of the previously typed character. Typing two back spaces will delete the previous two characters. The back space is initially defined to be a 'control H' but may be redefined by the user using the TTYSET utility command. The second special character is the line 'delete' character. Typing this character will effectively delete all of the characters which have been typed on the current line. A new prompt will be output to the terminal, but instead of the usual '+++' prompt, to show the action of the delete character, the prompt will be '???'. Any time the delete character is used, the new prompt will be '???', and signifies that the last line typed did not get entered into the computer. The delete character is initially a 'control X' but may also be redefined using TTYSET.

As mentioned earlier, the first name on a command line is always interpreted as a command. Following the command is an optional list of names and parameters, depending on the particular command being entered. The fields of a command line must be separated by either a space or a comma. The general format of a command line is:

<command>[,<list of names and parameters>]

A comma is shown, but a space may be used. FLEX also allows several commands to be entered on one command line by use of the 'end of line' character. This character is initially a colon (':'), but may be user defined with the TTYSET utility. By ending a command with the end of line character, it is possible to follow it immediately with another command. FLEX will execute all commands on the line before returning with the '+++' prompt. An error in any of the command entries will cause the system to terminate operation of that command line and return with the prompt. Some examples of valid command lines follow:

```
+++CAT 1
+++CAT 1:ASN S=1
+++LIST LIBRARY:CAT 1:CAT 0
```

As many commands may be typed in one command line as desired, but the total number of characters typed must not exceed 128. Any excess characters will be ignored by FLEX.

One last system feature to be described is the idea of 'system' and 'working' drives. As stated earlier, if a file specification does not specifically designate a drive number, it will assume a default value. This default value will either be the current 'system' drive assignment or the current 'working' drive assignment. The system drive is the default for all command names, or in other words, all file names which are typed first on a command line. Any other file name on the command line will default to the working drive. This version of FLEX also supports automatic drive searching. When in the auto search mode if no drive numbers are specified, the operating system will first search drive 0 for the file. If the file is not found, drive 1 will be searched and so on. When the system is first initialized the auto drive searching mode will be selected. At this time, all drive defaults will be to drive 0. It is sometimes convenient to assign drive 1 as the working drive in which case all file references, except commands, will automatically look on drive 1. It is then convenient to have a diskette in drive 0 with all the system utility commands on it (the 'system drive'), and a disk with the files being worked on in drive 1 (the 'working drive'). If the system drive is 0 and the working drive is 1, and the command line was:

```
+++LIST TEXTFILE
```

FLEX would go to drive 0 for the command LIST and to drive 1 for the file TEXTFILE. The actual assignment of drives is performed by the ASN utility. See its description for details.

VI. COMMAND DESCRIPTIONS

There are two types of commands in FLEX, memory resident (those which actually are part of the operating system) and disk utility commands (those commands which reside on the disk and are part of the UCS). There are only two resident commands, GET and MON. They will be described here while the UCS is described in the following sections.

GET

WARNING! check area of memory used.

The GET command is used to load a binary file into memory. It is a special purpose command and is not often used. It has the following syntax:

```
GET[,<file name list>]
```

where <file name list> is: <file spec>[,<file spec>] etc.

Again the '[' suround optional items. 'File spec' denotes a file name as described earlier. The action of the GET command is to load the file or files specified in the list into memory for later use. If no extension is provided in the file spec, BIN is assumed, in other words, BIN is the default extension. Examples:

```
GET,TEST
GET,1.TEST,TEST2.0
```

where the first example will load the file named 'TEST.BIN' from the assigned working drive, and the second example will load TEST.BIN from drive 1 and TEST2.BIN from drive 0.

MON

MON is used to exit FLEX and return to the hardware monitor system such as S-BUG. The syntax for this command is simply MON followed by the 'RETURN' key.

NOTE: to re-enter FLEX after using the MON command, you should enter the program at location CD03 hex.

UTILITY COMMAND SET

The following pages describe all of the utility commands currently included in the UCS. You should note that the page numbers denote the first letter of the command name, as well as the number of the page for a particular command. For example, 'B.1.2' is the 2nd page of the description for the 1st utility name starting with the letter 'B'.

COMMON ERROR MESSAGES

Several error messages are common to many of the FLEX utility commands. These error messages and their meanings include the following:

NO SUCH FILE. This message indicates that a file referenced in a particular command was not found on the disk specified. Usually the wrong drive was specified (or defaulted), or a misspelling of the name was made.

ILLEGAL FILE NAME. This can happen if the name or extension did not start with a letter, or the name or extension field was too long (limited to 8 and 3 respectively). This message may also mean that the command being executed expected a file name to follow and one was not provided.

FILE EXISTS. This message will be output if you try to create a file with a name the same as one which currently exists on the same disk. Two different files with the same name are not allowed to exist on the same disk.

SYNTAX ERROR. This means that the command line just typed does not follow the rules stated for the particular command used. Refer to the individual command descriptions for syntax rules.

GENERAL SYSTEM FEATURES

Any time one of the utility commands is sending output to the terminal, it may be temporarily halted by typing the 'escape' character (see TTYSET for the definition of this character). Once the output is stopped, the user has two choices: typing the 'escape' character again or typing 'RETURN'. If the 'escape' character is typed again, the output will resume. If the 'RETURN' is typed, control will return to FLEX and the command will be terminated. All other characters are ignored while output is stopped.

APPEND

The APPEND command is used to append or concatenate two or more files, creating a new file as the result. Any type of file may be appended but it only makes sense to append files of the same type in most cases. If appending binary files which have transfer addresses associated with them, the transfer address of the last file of the list will be the effective transfer address of the resultant file. All of the original files will be left intact.

DESCRIPTION

The general syntax for the APPEND command is as follows:

```
APPEND,<file spec>[,<file list>],<file spec>
```

where <file list> can be an optional list of the specifications. The last name specified should not exist on the disk since this will be the name of the resultant file. If the last file name given does exist on the disk, the question "MAY THE EXISTING FILE BE DELETED?" will be displayed. A Y response will delete the current file and cause the APPEND operation to be completed. A N response will terminate the APPEND operation. All other files specified must exist since they are the ones to be appended together. If only 2 file names are given, the first file will be copied to the second file. The extension default is TXT unless a different extension is used on the FIRST FILE SPECIFIED, in which case that extension becomes the default for the rest of the command line. Some examples will show its use:

```
APPEND,CHAPTER1,CHAPTER2,CHAPTER3,BOOK  
APPEND,FILE1,1.FILE2.BAK,GOODFILE
```

The first line would create a file on the working drive called 'BOOK.TXT' which would contain the files 'CHAPTER1.TXT', 'CHAPTER2.TXT', and 'CHAPTER3.TXT' in that order. The second example would append 'FILE2.BAK' from drive 1 to FILE1.TXT from the working drive and put the result in a file called 'GOODFILE.TXT' on the working drive. The file GOODFILE defaults to the extension of TXT since it is the default extension. Again, after the use of the APPEND command, all of the original files will be intact, exactly as they were before the APPEND operation.

ASN

The ASN command is used for assigning the 'system' drive and the 'working' drive or to select automatic drive searching. The system drive is used by FLEX as the default for command names or, in general, the first name on a command line. The working drive is used by FLEX as the default on all other file specifications within a command line. Upon initialization, FLEX assigns drive #0 as both the system and working drive. An example will show how the system defaults to these values:

```
APPEND,FILE1,FILE2,FILE3
```

If the system drive is assigned to be #0 and the working drive is assigned to drive #1, the above example will perform the following operation: get the APPEND command from drive #0 (the system drive), then append FILE2 from drive #1 (the working drive) to FILE1 from drive #1 and put the result in FILE3 on drive #1. As can be seen, the system drive was the default for APPEND where the working drive was the default for all other file specs listed.

Automatic drive searching causes FLEX to automatically scan the ready drives for the file specified. On systems using the 5-inch drives with either a DC-1 or DC-2 controller, no ready signal is provided by the drives, thus flex always assumes drives zero and one are ready. If a drive is selected that does not have a disk inserted, the system will hang until a disk is placed in the drive or the RESET switch is pressed. Systems using 8-inch drives, or 5-inch drives with the DC-3 controller provide a ready signal and drives with no disks inserted are bypassed.

Automatic drive searching causes FLEX to first check drive #0 for the file specified. If not there or if not ready FLEX will skip to drive #1. If the file is not found on drive #1 in the 5-inch version, FLEX gives up and a file not found error results. In the 8-inch version FLEX continues to search on drives #2 and #3 before reporting an error.

DESCRIPTION

The general syntax for the ASN command is as follows:

```
ASN[,W=<drive>][,S=<drive>]
```

where <drive> is a single digit drive number or the letter A. If just ASN is typed followed by a 'RETURN', no values will be changed, but the system will output a message which tells the current assignments of the system and working drives, for example:

```
+++ASN
THE SYSTEM DRIVE IS #0
THE WORKING DRIVE IS #0
```


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Some examples of using the ASN command are:

```
ASN,W=1
ASN,S=1,W=0
```

where the first line would set the working drive to 1 and leave the system drive assigned to its previous value. The second example sets the system drive to 1 and the working drive to 0. Careful use of drive assignments can allow the operator to avoid the use of drive numbers on file specifications most of the time!

If auto drive searching is desired, then the letter A for automatic, should be used in place of the drive number.

Example:

```
ASN W=A
ASN S=A, W=1
ASN S=A, W=A
```


AR

The archive command is used to update selected files on a disk by copying from one disk to another. This allows only those files that are obsolete to be replaced with newer copies from another disk.

DESCRIPTION

The general syntax of the AR command is:

AR,<input drive>,<output drive>

The selected files are copied from the input drive to the output drive.

The AR command may be thought of as a "copy only if there and more recent" command. The only files copied from the input drive to the output drive are those files that exist on both disks. Further, the creation date of the file to be copied must be more recent than the creation date of the file to be replaced.

The volume name and number of both the input and output drives is displayed and the operator is asked if he wishes to continue. An "N" answer will abort processing and return control to the operating system. To continue with the update a "Y" answer is required.

When a file is found which meets the selection criteria, the operator is asked if the file is to be copied. An "N" answer allows processing to continue without copying the file. A "Y" answer causes the file to be copied before continuing. Typing a Carrier Return will abort processing and return control to the operating system.

The prompting used by AR is designed for convenient use with the Y and N commands described elsewhere in this manual. In fact, a useful method for displaying a catalog of all files which need updating is to use the following command line.

++N,AR,0,1

After answering "Y" to the first question, a list of all files which need updating will be displayed.

NOTE: Some early versions of the COPY command did not copy the file's creation date, resulting in "creation" dates reflecting the date of the preceding use of COPY rather than the actual creation date of the file. Attempts to use AR to copy files generated by such a version of COPY will not be particularly useful since AR depends on the creation date being an actual creation date. Any copies of these early versions of the COPY command should be replaced with the current version.

The user will find it useful to be familiar with the TOUCH and DATE commands when using the AR command.

BUILD

The BUILD command is provided for those desiring to create small text files quickly (such as STARTUP files, see STARTUP) or not wishing to use the optionally available FLEX Text Editing System. The main purpose for BUILD is to generate short text files for use by either the EXEC command or the STARTUP facility provided in FLEX.

DESCRIPTION

The general syntax of the BUILD command is:

BUILD,<file spec>

where <file spec> is the name of the file you wish to be created. The default extension for the spec is TXT and the drive defaults to the working drive. If the output file already exists the question "MAY THE EXISTING FILE BE DELETED?" will be displayed. A Y response will delete the existing file and build a new file while a N response will terminate the BUILD command.

After you are in the 'BUILD' mode, the terminal will respond with an equals sign ('=') as the prompt character. This is similar to the Text Editing System's prompt for text input. To enter your text, simply type on the terminal the desired characters, keeping in mind that once the 'RETURN' is typed, the line is in the file and can not be changed. Any time before the 'RETURN' is typed, the backspace character may be used as well as the line delete character. If the delete character is used, the prompt will be '???' instead of the equals sign to show that the last line was deleted and not entered. It should be noted that only printable characters (not control characters) may be entered into text files using the BUILD command.

To exit the BUILD mode, it is necessary to type a pound sign ('#') immediately following the prompt, then type 'RETURN'. The file will be finished and control returned back to FLEX where the three plus signs should again be output to the terminal. This exiting is similar to that of the Text Editing System.

CAT

The CATalog command is used to display the FLEX disk file names in the directory on each disk. The user may display selected files on one or multiple drives if desired.

DESCRIPTION

The general syntax of the CAT command is:

```
CAT[,<drive list>][,<match list>]
```

where <drive list> can be one or more drive numbers separated by commas, and <match list> is a set of name and extension characters to be matched against names in the directory. For example, if only file names which started with the characters 'VE' were to be cataloged, then VE would be in the match list. If only files whose extensions were 'TXT' were to be cataloged, then .TXT should appear in the match list. A few specific examples will help clarify the syntax:

```
+++CAT
+++CAT,1,A.T,DR
+++CAT,PR
+++CAT,0,1
+++CAT,0,1,.CMD,.SYS
```

The first example will catalog all file names on the working drive or on all drives if auto drive searching is selected. The second example will catalog only those files on drive 1 whose names begin with 'A' and whose extensions begin with 'T', and also all files on drive 1 whose names start with 'DR'. The next example will catalog all files on the working drive (or on all drive if auto drive searching is selected) whose names start with 'PR'. The next line causes all files on both drive 0 and drive 1 to be cataloged. Finally, the last example will catalog the files on drive 0 and 1 whose extensions are CMD or SYS.

During the catalog operation, before each drive's files are displayed, a header message stating the drive number is output to the terminal. The name of the diskette as entered during the NEWDISK operation will also be displayed. The actual directory entries are listed in the following form:

NAME.EXTENSION	SIZE	PROTECTION	CODE
----------------	------	------------	------

where size is the number of sectors that file occupies on the disk. If more than one set of matching characters was specified on the command line, each set of names will be grouped according to the characters they match. For example, if all .TXT and .CMD files were cataloged, the TXT types would be listed together, followed by the CMD types.

In summary, if the CAT command is not parameterized, then all files on the assigned working drive will be displayed. If a working drive is not assigned (auto drive searching mode) the CAT command will display files

on all on line drives. If it is parameterized by only a drive number, then all files on that drive will be displayed. If the CAT command is parameterized by only an extension, then only files with that extension will be displayed. If only the name is used, then only files which start with that name will be displayed. If the CAT command is parameterized by only name and extension, then only files of that root name and root extension (on the working drive) will be displayed. Learn to use the CAT command and all of its features and your work with the disk will become a little easier.

The current protection code options that can be displayed are as follows:

D	File is delete protected (delete or rename prohibited)
W	File is write protected (delete, rename and write prohibited)
(blank)	No special protection

COPY

The COPY command is used for making copies of files on a disk. Individual files may be copied, groups of name-similar files may be copied, or entire disks may be copied. The copy command is a very versatile utility. The COPY command also re-groups the sectors of a file in case they were spread all over the old disk. This regrouping can make file access times much faster. It should be noted that before copying files to a new disk, the disk must be formatted first. Refer to NEWDISK for instructions on this procedure.

DESCRIPTION

The general syntax of the COPY command has three forms:

- a. COPY,<file spec>,<file spec>
- b. COPY,<file spec>,<drive>
- c. COPY,<drive>,<drive>[,<match list>]

where <match list> is the same as that described in the CAT command and all rules apply to matching names and extensions. When copying files, if the destination disk already contains a file with the same name as the one being copied, the file name and the message, "FILE EXISTS DELETE ORIGINAL?" will be output to the terminal. Typing Y will cause the file on the destination disk to be deleted and the file from the source disk will be copied to the destination disk. Typing N will direct FLEX not to copy the file in question.

The first type of COPY allows copying a single file into another. The output file may be on a different drive but if on the same drive the file names must be different. It is always necessary to specify the extension of the input file but the output file's extension will default to that of the input's if none is specified. An example of this form of COPY is:

```
+++COPY,0.TEST.TXT,1.TEST25
```

This command line would cause the file TEST.TXT on drive 0 to be copied into a file called TEST25.TXT on drive 1. Note how the second file's extension defaulted to TXT, the extension of the input file.

The second type of COPY allows copying a file from one drive to another drive with the file keeping its original name. An example of this is:

```
+++COPY,0.LIST.CMD,1
```

Here the file named LIST.CMD on drive 0 would be copied to drive 1. It is again necessary to specify the file's extension in the file specification. This form of the command is more convenient than the previous form if the file is to retain its original name after the copying process.

The final form of COPY is the most versatile and the most powerful. It is possible to copy all files from one drive to another, or to copy only those files which match the match list characters given. Some examples will clarify its use:

```
+++COPY,0,1  
+++COPY,1,0,.CMD,.SYS  
+++COPY,0,1,A,B,CA.T
```

The first example will copy all files from drive 0 to drive 1 keeping the same names in the process. The second example will copy only those files on drive 1 whose extensions are CMD and SYS to drive 0. No other files will be copied. The last example will copy the files from drive 0 whose names start with 'A' or 'B' regardless of extension, and those files whose names start with the letters 'CA' and whose extensions start with 'T'. to the output drive which is drive 1. The last form of copy is the most versatile because it will allow putting just the command (CMD) files on a new disk, or just the SYS files, etc., with a single command entry. During the COPY process, the name of the file which is currently being copied will be output to the terminal, as well as the drive to which it is being copied.

C4MAT

The C4MAT command is used to format the CalComp Marksman hard disk. It performs a surface verification and format function similar to the NEWDISK utility.

DESCRIPTION

The general syntax of the C4MAT command is:

C4MAT

This command will initialize the entire surface of the hard disk. It is important to format the disk initially to build directories and sector maps. Once initialized, the disk should never need to be reinitialized unless catastrophic damage occurs (like a wild program writing all over the disk). The initialization process destroys all data previously on the disk and it is vital that disks with good data not be formatted. The C4MAT program required approximately two hours to run.

When the C4MAT program is run, it will ask you if you are sure you want to initialize the disk. If you do, type "Y". C4MAT will then ask for a volume name, which can be up to eight characters in length. The volume name is stored in the disk information sector and is displayed by the CAT command and others. Be absolutely sure the disk is not write protected when you run the C4MAT program. An initial directory capable of storing up to 250 files is build upon the disk. The directory will expand if more than 250 files are placed on the disk.

Due to the large size and high density of the disk, it is not unusual for several bad sectors to be found. The program will abort if it cannot find at least 60,000 good free sectors on the disk. All bad sectors are automatically bypassed.

DATE

The DATE command is used to display or change an internal FLEX date register. This date register may be used by future programs and FLEX utilities.

DESCRIPTION

The general syntax of the DATE command is:

```
DATE[,<day,month,year>]
```

where 'month' is the numerical month, 'day' is the numerical day and 'year' is the last two digits of the year.

```
+++DATE 2,5,79 Sets the date register to May 2, 1979
```

Typing DATE followed by a carriage return will return the last entered date.

Example:

```
+++DATE  
May 2, 1979
```


DELETE

The DELETE command is used to delete a file from the disk. Its name will be removed from the directory and its sector space will be returned to the free space on the disk.

DESCRIPTION

The general syntax of the DELETE command is:

```
DELETE,<file spec>[,<file list>]
```

where <file list> can be an optional list of file specifications. It is necessary to include the extension on each file specified. As the DELETE command is executing it will prompt you with:

```
DELETE "FILE NAME"?
```

The entire file specification will be displayed, including the drive number. If you decide the file should be deleted, type 'Y'; otherwise, any other response will cause that file to remain on the disk. If a 'Y' was typed, the message 'ARE YOU SURE?' will be displayed on the terminal. If you are absolutely sure you want the file deleted from the disk, type another 'Y' and it will be gone. Any other character will leave the file intact. ONCE A FILE HAS BEEN DELETED, THERE IS NO WAY TO GET IT BACK! Be absolutely sure you have the right file before answering the prompt questions with Y's. Once the file is deleted, the space it had occupied on the disk is returned back to the list of free space for future use by other files. Few examples follow:

```
+++DELETE,MATHPACK.BIN  
+++DELETE,1.TEST.TXT,0.AUGUST.TXT
```

The first example will DELETE the file named MATHPACK.BIN from the working drive. If auto drive searching is selected, the file will be deleted from the first drive it is found on. The second line will DELETE the file TEST.TXT from drive 1, and AUGUST.TXT from drive 0.

There are several restrictions on the DELETE command. First, a file that is delete or write protected may not be deleted without first removing the protection. Also a file which is currently in the print queue (see the PRINT command) can not be deleted using the DELETE command.

ECHO

The ECHO command is a utility that permits messages and control characters to be sent to the terminal device. It is particularly useful when used inside of EXEC files.

DESCRIPTION

The general syntax of the ECHO command is:

```
ECHO,<string>
```

where string is any string of printable characters or control escape sequences terminated by a carriage return or an end of line character. Some examples of the echo command are:

```
ECHO,THIS IS A MESSAGE  
ECHO,\G THE FILE HAS BEEN DELETED!
```

The first example types "THIS IS A MESSAGE" on the terminal. The second example uses a control escape sequence to send a bell character (Control "G") to the terminal, followed by the message "THE FILE HAS BEEN DELETED!".

Control escape sequences provide a mechanism to send control characters to the terminal device, for example a bell character may be sent to provide an audible alert signal. These sequences begin with a backslash character followed by an upper case letter or symbol. The 'control' value of the symbol is sent to the terminal. For example, the sequence "\G" sends a control-G character. Two other escape sequences available are "\0" which sends a null character (control-shift-P) and "\n" (Lower case "N") which sends a carriage return, line feed to the terminal.

EXEC

The EXECute command is used to process a text file as a list of commands, just as if they had been typed from the keyboard. This is a very powerful feature of FLEX for it allows very complex procedures to be built up as a command file. When it is desirable to run this procedure, it is only necessary to type EXEC followed by the name of the command file. Essentially all EXEC does is to replace the FLEX keyboard entry routine with a routine which reads a line from the command file each time the keyboard routine would have been called. The FLEX utilities have no idea that the line of input is coming from a file instead of the terminal.

DESCRIPTION

The general syntax of the EX command is:

EXEC,<file spec>

where <file spec> is the name of the command file. The default extension is TXT. An example will give some ideas on how EXEC can be used. One set of commands which might be performed quite often is the set to make a new system diskette on drive 1 (see NEWDISK). Normally it is necessary to use NEWDISK and then copy all .CMD and all .SYS files to the new disk. Finally the LINK must be performed. Rather than having to type this set of commands each time it was desired to produce a new system diskette, we could create a command file called MAKEDISK.TXT which contained the necessary commands. The BUILD utility should be used to create this file. The creation of this file might go as follows:

```
+++BUILD,MAKEDISK
  =NEWDISK,1
  =COPY,0,1,.CMD,.OV,.LOW,.SYS
  =LINK,1.FLEX
  =#
+++
```

The first line of the example tells FLEX we wish to BUILD a file called MAKEDISK (with the default extension of .TXT). Next, the three necessary command lines are typed in just as they would be typed into FLEX. The COPY command will copy all files with CMD, OV, LOW, and SYS extensions from drive 0 to drive 1. Finally the LINK will be performed. Now when we want to create a system disk we only need to type the following:

```
+++EXEC,MAKEDISK
```

We are assuming here that MAKEDISK resides on the same disk which contains the system commands. EXEC can also be used to execute the STARTUP file (see STARTUP).

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There are many applications for the EXEC command. The one shown is certainly useful but experience and imagination will lead you to other useful applications.

IMPORTANT NOTE: The EXEC utility is loaded into the upper end of user memory. This is done by first loading EXEC into the utility command space, then calculating the proper starting address so that it will reside right up against the end of the user memory space. Next EXEC is relocated to that location and a new end of memory pointer is set to just below EXEC. When the EXEC file is finished, if the user has not further changed the memory end location, EXEC will reset it to the original value.

FIX

The FIX command is used to modify binary files that are stored on the disk. Since the FIX command loads the file into an internal buffer, it is possible to modify binary files that have several segments or that load into system locations.

DESCRIPTION

The general syntax of the FIX command is:

FIX,<file name>

where <file spec> is the name of the file you wish to modify. The default extension for FIX is .BIN and the drive defaults to the working drive.

When you run the FIX command, the computer will load the binary file into its internal buffer memory. If for some reason the file cannot be loaded into memory, an error message is produced and the file is left unmodified. After the file has been loaded, FIX will respond with a prompt character, ":", and will then accept one of the following single-letter commands:

- M -- Memory Examine and Change. This command is used to examine or modify a byte in the file. It cannot be used to extend the file by adding additional bytes. See the detailed description below.
- X -- Exit (Give Up). No modified data is written back to the disk. (The file is left intact.) This command is useful if you have managed to screw up the file while making modifications.
- T -- Specify the transfer address. For example to change the transfer address to \$0100, type :T 0100.
- U -- Remove the transfer address from the file. See the description of a binary file in the advanced programmer's guide.
- E -- Exit. All data that was modified is written back to the file on the disk. The resulting file has all of the object code blocks that were present in the original file, plus any new blocks that have been added. There may be exactly one transfer address in the file, and it will be the last block in the file. The exit command will delete the old binary file and write a new file in its place.
- B -- Add a new block of data to the file. This command requires a pair of addresses specifying the lower and upper bounds of the block to be added. The maximum size of a block to be added is 252 bytes and the block is initially cleared to zeros. For example, to add a sixteen byte object code block at location \$0700, type :B 0700-070F. Added blocks may be modified with the examine and change function.

FIX Memory Examine and Change

The memory examine and change function of fix permits the programmer to look at and change bytes in a binary file by referencing the address at which they will load. This function cannot be used to add additional bytes to the binary file. If you need to add data, use the "B" command to create the new bytes, and then use the memory command to change them.

- 1.) Enter the "M" command followed by the four digit address of the byte you wish to examine or change. The computer will display the address followed by the data found in the byte. If no such byte exists in the binary file, a question mark will be shown.
- 2.) At this point the user has the option of advancing, either forward or backward, to the next memory location, changing the data stored at the displayed address and advancing to the next location, or of exiting the examine and change function.
 - a.) To display the next sequential address and data, type a space.
 - b.) To display the previous address and data, type the up-arrow, "^".
 - c.) To change the data stored at the displayed location simply enter the new data as two hexadecimal digits. If a non-hex value such as "3Q" is entered the data will remain unchanged and the memory change function will step to the next sequential address.
 - d.) If a delete character (control-X) or a backspace character (control-H) is typed, the current address and data is redisplayed.
 - e.) To exit the Memory Examine and Change function, type a carriage return.

I

The I command allows a utility to obtain input characters from a disk file rather than the terminal.

DESCRIPTION

The general syntax of the I command is:

```
I,<file spec>,<command>
```

where <file spec> is the name of the file containing the characters to be used as input and <command> is the FLEX utility command that will be executed and that will receive that input from <file spec>. The default extension on <file spec> is .TXT.

For example, say that on a startup you always wanted the file DATA.DAT deleted from the disk without having to answer the "ARE YOU SURE?" questions. This could be done in the following manner:

```
+++BUILD,YES  
=YY  
=#
```

The first Y will answer the "DELETE O.DATA.DAT?" question while the second Y will answer the "ARE YOU SURE?" question.

```
+++BUILD,STARTUP  
=I,YES,DELETE,DATA.DAT  
=#
```

Upon booting the disk, FLEX will execute the STARTUP file and perform the following operation: delete the file DATA.DAT receiving all answers to any questions from the input file YES.TXT rather than from the terminal.

See the description of the STARTUP command for more information on STARTUP.

JUMP

The JUMP command is provided for convenience. It is used to start execution of a program already stored in computer RAM memory.

DESCRIPTION

The general syntax of the JUMP command is:

JUMP,<hex address>

where <hex address> is a 1 to 4 digit hex number representing the address where program execution should begin. The primary reason for using JUMP is if there is a long program in memory already and you do not wish to load it off of the disk again. Some time can be saved but you must be sure the program really exists before JUMPing to it!

As an example, suppose we had a BASIC interpreter in memory and it had a 'warm start' address of 103 hex. To start its execution from FLEX we type the following:

+++JUMP,103

The BASIC interpreter would then be executed. Again, remember that you must be absolutely sure the program you are JUMPing to is actually present in memory.

LINK

The LINK command is used to tell the bootstrap loader where the FLEX operating system file resides on the disk. This is necessary each time a system disk is created using NEWDISK. The NEWDISK utility should be consulted for complete details on the use of LINK.

DESCRIPTION

The general syntax of the LINK command is:

LINK,<file spec>

where <file spec> is usually FLEX. The default extension is SYS. Some examples of the use of LINK follow:

```
+++LINK,FLEX  
+++LINK,1.FLEX
```

The first line will LINK FLEX.SYS on the working drive, while the second example will LINK FLEX.SYS on drive 1. For more advanced details of the LINK utility, consult the "Advanced Programmers Guide".

LIST

The LIST command is used to LIST the contents of text or BASIC files on the terminal. It is often desirable to examine a files without having to use an editor or other such program. The LIST utility allows examining entire files, or selected lines of the file. Line numbers may also be optionally printed with each line.

DESCRIPTION

The general syntax of the LIST command is:

```
LIST,<file spec>[,<line range>][,+(options)]
```

where the <file spec> designates the file to be LISTed (with a default extension of TXT),and <line range> is the first and last line number of the file which you wish to be displayed. All lines are output if no range specification is given. The LIST command supports two additional options. If a +N option is given, line numbers will be displayed with the listed file. If a +P option is given, the output will be formatted in pages and LIST will prompt for "TITLE" at which time a title for the output may be entered. The TITLE may be up to 40 characters long. This feature is useful for obtaining output on a printer for documentation purposes (see P command). Each page will consist of the title, date, page number, 54 lines of output and a hex 0C formfeed character. Entering a +NP will select both options. A few examples will clarify the syntax used:

```
+++LIST,RECEIPTS
+++LIST,CHAPTER1,30-200,+NP
+++LIST,LETTER,100
```

The first example will list the file named 'RECEIPTS.TXT' without line numbers. All lines will be output unless the 'escape character' is used as described in the Utility Command Set introduction. The second example will LIST the 30th line through the 200th line of the file named 'CHAPTER1.TXT' on the terminal. The hyphen ('-') is required as the range number separator. Line numbering and page formatting will be output because of the '+NP' option. The last example shows a special feature of the range specification. If only one number is stated, it will be interpreted as the first line to be displayed. All lines following that line will also be LISTed. The last example will LIST the lines from line 100 to the end of the file. No line numbers will be output since the 'N' was omitted.

MV

The MV command is a file move utility. MV will take any actions required to generate a file with the specified name on the specified drive. The actions taken may include renaming a file, deleting an existing file, or physically moving a file.

DESCRIPTION

The general syntax of the MV command is:

```
MV,<source file spec> [,<target file spec>]
```

where <source file spec> is the name of the file to be moved, and <target file spec> is the name to be associated with the file. The default extension for the source file specification is ".TXT". The default drive number for the source file specification is the working drive.

If the target file specification is incomplete, those items that are missing will be supplied from the source file specification. In the following example, the completed target file specification will be "0.DATFILE.TXT":

```
+++MV,0.DATFILE.BAK,.TXT
```

In this example, the intention was to change the name of the file "DATFILE.BAK" on drive zero to "DATFILE.TXT". Note that if a file having the name "DATFILE.TXT" does not already exist on drive zero, the only action taken will be to rename the file "DATFILE.BAK" to have the name "DATFILE.TXT". If instead a file named "DATFILE.TXT" already exists, the action taken is to first delete the file "DATFILE.TXT", followed by renaming the file "DATFILE.BAK". In either event, the end result is that "DATFILE.BAK" is moved to "DATFILE.TXT".

It should be noted that all actions taken by the MV program are taken WITHOUT informing the operator of the details necessary to perform the move function. This includes any required move operations or the deletion of existing files.

Consider the case where the file "DATFILE.BAK" is protected against deletion (see the PROT command) in the following example. Since a file that is protected cannot be renamed, in order to obtain a file with the name "DATFILE.TXT" it is necessary to physically copy the file "DATFILE.BAK" into a new file named "DATFILE.TXT" on drive zero:

```
+++PROT,DATFILE.BAK,+D
+++MV,0.DATFILE.BAK,.TXT
-- Source file not deleted.
```

Since the file "DATFILE.BAK" is protected and hence cannot be deleted, the message "-- Source file not deleted." is displayed.

In the next example, the intention is to move the file "DATAFILE.TXT" from drive zero to drive one. This example illustrates another case where it is necessary for the MV command to copy the data in a file:

```
+++MV,0.DATAFILE,1
```

In this case, the completed source file specification is "0.DATAFILE.TXT" and the completed target file specification is "1.DATAFILE.TXT". In order to accomplish the specified move, the MV program must take the following actions:

1. If a file named "DATAFILE.TXT" already exists on drive one, it is deleted.
2. The file "DATAFILE.TXT" on drive zero is copied in its entirety to drive one. This process creates a duplicate of the original file, retaining the data and attributes of the original file.
3. Unless it is protected, the file "DATAFILE.TXT" on drive zero is deleted.

The end result of these actions is to place a file named "DATAFILE.TXT" on drive one which is identical to the file named "DATAFILE.TXT" which had previously existed on drive zero. That is, the file has been moved from drive zero to drive one.

In the final example, the working drive has been assigned to drive zero. The file "WORKFILE.TXT" exists on drive zero, but has been damaged due to operator oversight. A backup of this file, "WORKFILE.BAK" exists on drive one and will be used to replace the damaged file:

```
+++MV 1.WORKFILE,BAK,0..TXT
```

In this case, it is necessary to specify both the source file drive (which otherwise would default to drive zero) and the target file drive number. The completed target file specification will be "0.WORKFILE.TXT". The MV program will move the backup file by first deleting "WORKFILE.TXT" on drive zero, then copying the file "WORKFILE.BAK" from drive one to drive zero, and finally deleting the file on drive one. Again, all these actions take place without the intervention of the operator.

NEWDISK

Newdisk is used to format a new diskette. Diskettes as purchased will not work with FLEX until certain formatting information has been put on them. The NEWDISK utility puts this information on the blank diskette, as well as checking for surface defects on the media.

DESCRIPTION

The general syntax of the NEWDISK command is:

NEWDISK,<drive>

where <drive> represents a single digit drive number and specifies the drive to be formatted. After typing the command, the system will ask if you are sure you want to NEWDISK, and if the disk to be initialized is a scratch disk. Type 'Y' as the response to these questions if you are sure the NEWDISK command should continue. Certain versions of NEWDISK will also ask you if you want to make double-sided or double-density diskettes.. NEWDISK will then prompt for a volume name and number. This gives you the ability to "name" the diskette for future reference.

The NEWDISK process takes several minutes to initialize a disk, assuming there are no bad spots on it. Defective sectors will make NEWDISK run even slower, depending on the number of bad sectors found. As bad sectors are detected, a message will be output to the terminal such as:

BAD SECTOR AT xxyy

where 'xx' is the disk track number (in hex) and 'yy' is the sector number, also in hex. NEWDISK automatically removes bad sectors from the list of available sectors, so even if a disk has several bad spots on it, it is still usable. When NEWDISK finishes, it will report the number of available sectors on the disk.

Sometimes during the NEWDISK process, a sector will be found defective in an area on the disk which is required by the operating system. In such a case, NEWDISK will report:

FATAL ERROR - FORMATTING ABORTED

and FLEX will regain control. You should not immediately assume the disk to be useless if this occurs, but instead, remove the disk from the drive, re-insert it, and try NEWDISK again. If after several attempts the formatting is still aborted, you should assume the disk is unusable.

CREATING SYSTEM DISKETTES

A system disk is one from which the operating system can be loaded. Normally the system disk will also contain the Utility Command Set (UCS). The following procedure should be used when preparing system disks.

1. Initialize the diskette using NEWDISK as described above.
2. COPY all .SYS files desired to the new disk.
3. COPY all .CMD files to the new disk. It should be noted that steps 2 and 3 can be done with one command; "COPY,0,1,.SYS,.CMD,.OV,.LOW", assuming that the new disk is in drive 1 and that the operating system and all commands and their overlays are desired. (the .OV copies overlay files and .LOW copies the utility 'SAVE.LOW').
4. Last it is necessary to LINK the file FLEXⁿ.SYS to the system using the LINK command. * *

A very convenient way to get the above process performed without having to type all of the commands each time is to create a command file and use the EXEC command. Consult the EXEC documentation for details.

It is not necessary to make every disk a system diskette. It is possible to create 'working' diskettes, disks which do not have the operating system on them, for use with text files or BASIC files. Remember that a diskette can not be used for booting the system unless the operating system is contained on it and it has been linked. To create a working disk, simply run NEWDISK on a diskette. It will now have all of the required information to enable FLEX to make use of it. This disk, however, does not contain the disk operating system and is not capable of booting the system.

'n' => version of Flex eg 9
** * LINK , or . FLEX⁹.SYS*

N

The N command is used to automatically answer "N" to prompts produced by various FLEX utilities. This facility is especially useful when writing EXEC files.

DESCRIPTION

The general syntax of the N command is:

N,<command string>

where <command string> is a valid command line to be passed to FLEX. If the N command is used with multiple commands per line using the end of line character, it will only affect the command immediately following it. The N command is particularly useful when performing COPY operations that you do not wish to overwrite any existing files:

+++N,COPY,0,1,TEXT

```
FILE  TEXT1  .TXT  TO DRIVE #1  COPIED.
FILE  TEXT2  .TXT  TO DRIVE #1  FILE EXISTS
      DELETE ORIGINAL? N
FILE  TEXT3  .TXT  TO DRIVE #1  FILE EXISTS
      DELETE ORIGINAL? N
FILE  TEXT4  .TXT  TO DRIVE #1  COPIED.
```


The O (not zero) command can be used to route all displayed output from a utility to an output file instead of the terminal. The function of O is similar to P (the printer command) except that output is stored in a file rather than being printed on the terminal or printer. Other TSC software may support this utility. Check the supplied software instructions for more details.

DESCRIPTION

The general syntax of the O command is:

O,<file spec>,<command>

where <command> can be any standard utility command line and <file spec> is the name of the desired output file. The default extension on <file spec> is .OUT. If O is used with multiple commands per line (using the 'end of line' character ':') it will only have affect on the command it immediately precedes. Some examples will clarify its use.

+++O,CAT,CAT

writes a listing of the current disk directory into a file called CAT.OUT

+++O,BAS,ASMB,BASIC.TXT

writes the assembled source listing of the text source file 'BASIC.TXT' into a file called 'BAS.OUT' when using the assembler

P

The P command is used to direct the output of commands in the Utility Command Set to a parallel printer. It is normally used to produce hard copy output from text processors, assemblers, and other utility programs.

DESCRIPTION

The general syntax of the P command is:

P[#n],<command string>

where #n is optional and is the port number of the parallel interface connected to the printer and <command string> is a valid command line to be passed to FLEX. If the port number is not specified, it will default to port seven on /09 computer systems, and to the MP-ID printer port on S/09 systems. If the P command is used with multiple commands per line using the end of line character, it will only affect the command immediately following it in the command line. Some examples will clarify the use of the P command:

P,CAT

This example will produce a printed listing of the catalog of the working drive. The port number is omitted and defaults to port seven.

P#3,LIST,TEXT

This example will produce a printed listing of the file TEXT.TXT. The port has been specified as port number three.

When using dual parallel ports, the port side may be specified by using an A or B suffix to the port number. If the suffix is omitted, the A side of the port is used. For example, a port specification of 5B will use the B side of port number five.

The P command initially loads into the utility command space at \$C100. If sufficient memory has been reserved for the printer driver (see the RM command documentation) it will be relocated there, otherwise it will be relocated into the highest available locations in user memory and the end of user memory pointer will be updated. When the command to be printed has completed any user memory allocated to the printer driver will be released.

The parallel data and handshake conforms to the CENTRONIX® interface standard. This standard has been widely adopted for use with 8-bit ASCII printers and is available on nearly all parallel printers.

P.COR

The P.COR file is a command file that can be used to construct customized printer driver commands. It contains the relocation and memory management routines required to use position independant printer drivers.

DESCRIPTION

P.COR is never used as a command by itself. Special internal checks are made to insure that a printer driver has been properly appended to the P.COR file. In order to use P.COR, you must write a position independant printer driver that begins at memory address \$C300 and may extend up to location \$C6FF, thus allowing the driver to be up to 1K in length. This is normally sufficient space for any reasonable printer driver. For more information on writing a position independant driver, see section X in chapter 3.

Once the printer driver has been written and assembled, you must use the append command to combine the P.COR file with the printer driver. To clarify this procedure, consider the following example. A serial printer driver (A listing of this driver can be found in Chapter 3 section XI) named SERIAL has been assembled. In order to make a print command out of this driver, the following command line must be entered:

```
APPEND,P.COR,SERIAL.BIN,SERIAL.CMD
```

The result is a print command that functions like the P command. To use the new SERIAL command, enter

```
SERIAL[#n],<command string>
```

where #n is the port number (you have set the default) and <command string> is any command string to be passed to Flex.

PO

The PO command is the older version of the P command and has been included for compatability purposes.

DESCRIPTION

The general syntax of the PO command is:

PO,<command string>

where <command string> can be any standard utility command line. If PO is used with multiple commands per line (using the 'end of line' character), it will only have affect on the command it immediately preceeds. Some examples will clarify its use:

```
+++PO,CAT
+++PO,LIST,MONDAY:CAT,1
```

The first example would print a CATalog of the directory of the working drive on the printer. The second example will print a LISTing of the text file MONDAY.TXT and then display on the terminal a CATalog of drive 1 (this assumes the 'end of line' character is a ':'). Note how the PO did not cause the 'CAT,1' to go to the printer.

The PO command tries to load a file named PRINT.SYS from the same disk which PO itself was retrieved. The PRINT.SYS file which is supplied with the system diskette contains the necessary routines to operate a parallel printer connected to port seven of a /09 computer system. For complete details on these routines, refer to section XI of this publication.

PSP

The Print Spool Program provides FLEX with the ability to output stored data to a printer at the same time that it is performing other tasks. This method of printing is called Printer Spooling. This feature is especially useful when it is necessary to print a long listing without tying up the computer.

DESCRIPTION

The general syntax of the Print Spool Program is as follows:

PSP,[<spool file>] [,<print command>] [,<repeat count>]

where <spool file> is the name of the file to be printed (normally produced by the "O" command), <print command> is the name of the print command that will be used to drive the printer, and <repeat count> is the number of additional copies of print you require. The default extension of the spool file is .OUT and the default extension for the print command is .CMD.

For example, say that your disk had a very large number of files on it and a printer catalog listing was desired. A file containing the output information should first be created by using the O command such as:

+++O,CAT.OUT,CAT.CMD or +++O,CAT,CAT
(see the description of the O command)

When printer output is desired the command

+++PSP,CAT.OUT,P.CMD or +++PSP,CAT,P

should be entered.

At this time the location of the file CAT.OUT is stored in a buffer called a print queue (waiting list). If another PSP command is issued before the first is finished, the second file will be in the next available location in the print queue.

After the file name to be printed has been stored in the print queue, the PSP program will load the specified printer driver command into the printer reserved area (See the RM command). If the reserved area is not big enough, a message is issued and the program terminates. Otherwise, the spooling process is started and control returns to the FLEX command interpreter. Note that any of the relocatable printer commands may be used, including the Q and SP commands.

Once printing is in progress, it is not possible to change printer drivers until the spooling process has completed. For example, if you have three files that you wish to print on a Qume printer, and two on a serial printer, you must first spool the three Qume files and allow them to complete printing. You can then spool the two files destined for the serial printer.

During printing, you can perform flex commands from the terminal, such as deleting files, copying disks, etc. While you are using FLEX, the Print Spool Program will be printing the desired file. PSP will automatically wait for the printer to become ready (power up) even after the file has been entered into the print queue. After printing the first file, the second file in the queue will be printed (if there is one), etc. The print queue may be examined or modified at any time by using the QCHECK utility.

NOTE: There are several things that the user should be aware of when using the printer spooling:

- 1) Any file that is in the print queue may not be deleted, renamed, or changed in any way until it has been printed or removed by the QCHECK print queue manager utility.
- 2) Disks which contain the files in the print queue should not be removed while the files are still in the queue.
- 3) Non-Spooling print commands (like P) cannot be used while files are waiting in the print queue.
- 4) Any paper or cassette tape load or any other operation which requires that the computer accept data at precise time intervals should not be executed during a printer spooling operation.
- 5) In order for printer spooling to work in a non-S/09 computer system, an MP-T or MP-T2 interface must be installed in I/O port five and be strapped to provide IRQ interrupts.
- 6) The PSP command is not supported by FLEX9S.
- 7) The PSP command will function only with FLEX 9.0 Version 2.6 or above. If in doubt, check with "VER FLEX.SYS".

PROT

The PROT command is used to change a protection code associated with each file. When a file is first saved, it has no protection associated with it thereby allowing the user to write to, rename, or delete the file. Delete or write protection can be added to a file by using the PROT command.

DESCRIPTION

The general syntax of the PROT command is:

```
PROT,<file spec>[(option list)]
```

where the <file spec> designates the file to be protected and (option list) is any combination of the following options.

- D A 'D' will delete protect a file. A delete protected file cannot be affected by using the DELETE or RENAME Commands, or by the delete functions of SAVE, APPEND, etc.
- W A 'W' will write protect a file. A write protected file cannot be deleted, renamed or have any additional information written to it. Therefore a write protected file is automatically delete protected as well.
- C A 'C' will Catalog protect a file. Any files with a C protection code will function as before but will not be displayed when a CAT command is issued.
- X An 'X' will remove all protection options on a specific file.

Examples:

+++PROT CAT.CMD,XW	Remove any previous protection on the CAT.CMD Utility and write protect it.
+++PROT CAT.CMD,X	Remove all protection from the CAT.CMD utility.
+++PROT INFO.SYS,C	Prohibit INFO.SYS from being displayed in a catalog listing.

Q

The Q command is used to direct the output of commands in the Utility Command Set to a Qume Sprint-3™ printer attached to an MP-QP I/O interface. It is normally used to produce hard copy output from text processors, assemblers, and other utility programs.

DESCRIPTION

The general syntax of the Q command is:

`Q[#<n>][/<format>],<command string>`

where #<n> is optional and is the port number of the MP-QP interface connected to the printer, <format> is optional and is one of the letters A, B, C, D, E, or F, and <command string> is a valid command line to be passed to FLEX. If the port number is not specified, it will default to port seven. If the Q command is used with multiple commands per line using the end of line character, it will only affect the command immediately following it in the command line.

The format letter is separated from the port number or Q command by a slash character, and specifies the printwheel pitch and print spacing to be used. If the format character is omitted, it will default to format "B". This format represents standard elite spacing and is used with the WP LETTER GOTHIC 12 printwheel (number 80956) supplied with the printers. The following formats are available:

- A - 10 Characters/Inch Horizontal, 6 Lines/Inch Vertical
- B - 12 Characters/Inch Horizontal, 6 Lines/Inch Vertical
- C - 15 Characters/Inch Horizontal, 6 Lines/Inch Vertical
- D - 10 Characters/Inch Horizontal, 8 Lines/Inch Vertical
- E - 12 Characters/Inch Horizontal, 8 Lines/Inch Vertical
- F - 15 Characters/Inch Horizontal, 8 Lines/Inch Vertical

Some examples will clarify the use of the Q command:

`+++Q,CAT`

This example will produce a printed listing of the catalog of the working drive. The port number is omitted and defaults to port seven. The format is also omitted, and defaults to "B", 12 characters per inch horizontal, and 6 lines per inch vertical.

`+++Q#3,LIST,TEXT`

This example will produce a printed listing of the file TEXT.TXF. The port has been specified as port number three. No format is specified and the default "B" will be assumed.

+++Q/F,ROFF,LETTER

In this example, no port number is given so the default of seven will be selected. Format "F" has been selected so the printed output will be spaced 15 characters per inch horizontal, and 8 lines per inch vertical. This format provides 88 lines per 11 inch page, and matches the Qume GOTHIC 15 printwheel (number 82090).

The Q command initially loads into the utility command space at \$C100. If sufficient memory has been reserved for the printer driver (see the RM command documentation) it will be relocated there, otherwise it will be relocated into the highest available locations in user memory and the end of user memory pointer will be updated. When the command to be printed has completed any user memory allocated to the printer driver will be released.

QCHECK

The QCHECK utility can be used to examine the contents of the print queue and to modify its contents. QCHECK has no additional arguments with it. Simply type QCHECK. QCHECK will stop any printing that is taking place and then display the current contents of the print queue as follows:

```
+++QCHECK
      POS      NAME      TYPE      RPT
        1      TEST.     .OUT       2
        2      CHPTR.    .OUT       0
        3      CHPTR2.   .TXT       0
COMMAND?
```

This output says that TEST.OUT is the next file to be printed (or that it is in the process of being printed) and that 3 copies (1 plus a repeat of 2) of this file will be printed. After these three copies have been printed, CHPTR.OUT will be printed and then CHPTR2.TXT. The COMMAND? prompt means QCHECK is waiting for one of the following commands:

COMMAND	FUNCTION
---------	----------

(carriage return)	Re-start printing, return to the FLEX command mode.
-------------------	---

Q	A Q command will print the queue contents again.
---	--

R, #N, X	An R command repeats the file at position #N X times. If X is omitted the repeat count will be cleared. Example: R, #3, 5
----------	---

D, #N	A D command removes the file at queue position #N. If N=1, the current print job will be terminated. Example: D, #3
-------	---

T	A T command will terminate the current print job. This will cause the job currently printing to quit and printing of the next job to start. If the current files RPT count was not zero, it will print again until the repeat count is 0. To completely terminate the current job use the D, #1 command.
---	--

N, #N	A N command will make the file at position #N the next one to be printed after the current print job is finished. Typing Q after this operation will show the new queue order. Example: N, #3
-------	---

S	An S command will cause printing to stop. After the current job is finished, printing will halt until a G command is issued.
---	--

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A G command will re-start printing after an S command has been used to stop it.

K A K command will kill the current print process. All printing and queued jobs will be removed from the queue. The files are not deleted from disk.

The QCHECK command is not supported under FLEX9S.

RENAME

The RENAME command is used to give an existing file a new name in the directory. It is useful for changing the actual name as well as changing the extension type.

DESCRIPTION

The general syntax of the RENAME command is:

```
RENAME,<file spec 1>,<file spec 2>
```

where <file spec 1> is the name of the file you wish to RENAME and <file spec 2> is the new name you are assigning to it. The default extension for file spec 1 is TXT and the default drive is the working drive. If no extension is given on <file spec 2>, it defaults to that of <file spec 1>. No drive is required on the second file name, and if one is given it is ignored. Some examples follow:

```
+++RENAME,TEST1.BIN,TEST2
+++RENAME,1.LETTER,REPLY
+++RENAME,0.FIND.BIN,FIND.CMD
```

The first example will RENAME TEST1.BIN to TEST2.BIN. The next example RENAMES the file LETTER.TXT on drive 1 to REPLY.TXT. The last line would cause the file FIND.BIN on drive 0 to be renamed FIND.CMD. This is useful for making binary files created by an assembler into command files (changing the extension from BIN to CMD). If you try to give a file a name which already exists in the directory, the message:

FILE EXISTS

will be displayed on the terminal. Keep in mind that RENAME only changes the file's name and in no way changes the actual file's contents.

One last note of interest. Since utility commands are just like any other file, it is possible to rename them also. If you would prefer some of the command names to be shorter, or different all together, simply use RENAME and assign them the names you desire.

RM

The RM command is used to Reserve Memory in which to load printer drivers that are too large to fit in the actual printer driver area. This command is primarily intended to permit the use of large printer drivers (such as the QUME™ driver) with programs like BASIC that use all available memory.

DESCRIPTION

The general syntax of the RM command is:

RM[,<size>] or RM?

where <size> is a decimal number indicating the amount of memory to be reserved for the printer drivers. If not specified, the size parameter defaults to 512 bytes. If memory has previously been reserved for printer drivers, the RM command will adjust the amount of memory available as necessary. In order to get rid of the reserved memory, it is only necessary to run the RM command with a size value of zero. If the second form of the RM command is used, the amount of reserved memory will be reported.

Flex™ itself reserves approximately 56 bytes of memory for printer driver code and defines the printer vector locations. While this is sufficient to run simple parallel or serial printers, it is not enough memory to hold drivers for more complicated devices, for example, serial printers requiring buffers and line protocol. The RM command allows the user to reserve a memory area for the printer drivers that will be off limits to programs like BASIC that use all available memory. Note that it is NOT necessary to use the RM command to use the printer commands like P and Q.

Some examples of using the RM command follow:

RM,700
RM?
RM,0

The first example will reserve 700 bytes of memory for use as a printer area. The second example will display that 700 bytes are reserved, and the third example will free the memory reserved for the printer.

READPROM

The READPROM command is used to read the data from a 2716 compatible EPROM in a SWTPC MP-R EPROM programmer to a binary disk file. Its primary use is for copying and modifying the contents of EPROMs.

DESCRIPTION

The general syntax of the READPROM command is:

READPROM[#n], <file spec>

Where #n is optional and is the port number in which the PROM programmer is installed and <file spec> is the name to be assigned to the output file. The default extension on the file is .BIN and the default drive is the working drive. The default port for READPROM is #4. Some examples will clarify the use of READPROM.

```
+++READPROM,JUNK
+++READPROM#7,JUNK.1
```

The first example will store the contents of the EPROM on the programmer in port #4 to the file JUNK.BIN on the working drive. The second example will read the EPROM on the programmer in port 7 and store its contents in the file JUNK.BIN on drive 1. If an attempt is made to save a program under a file name that already exists, the prompt "MAY THE EXISTING FILE BE DELETED?" will be displayed. A Y response will replace the file with the new data to be saved while a N response will terminate the save operation.

The output file generated by READPROM will be 2048 (2K) bytes in length with a load address of 0000. No transfer address will be assigned to the file.

The EPROM should not be installed in the programmer until the READPROM command tells you to.

Default Port Addresses

If desired, the default port address can be changed by using the FIX utility on READPROM.CMD.

<u>READPROM Address</u>	<u>Contents</u>
C100	S/09, 69A, 69K Default Port Address
C102	/09 Default Port Address

The S command is used to direct the output of commands in the Utility Command Set to a serial printer. It is normally used to produce hard copy output from text processors, assemblers, and other utility programs.

DESCRIPTION

The general syntax of the S command is:

S[#n],<command string>

where #n is optional and is the port number of the serial interface connected to the printer and <command string> is a valid command line to be passed to FLEX. If the port number is not specified, it will default to port seven. If the S command is used with multiple commands per line using the end of line character, it will only affect the command immediately following it in the command line. Some examples will clarify the use of the S command:

S,CAT

This example will produce a printed listing of the catalog of the working drive. The port number is omitted and defaults to port seven.

S#3,LIST,TEXT

This example will produce a printed listing of the file TEXT.TXT. The port has been specified as port number three.

When using dual serial ports, the port side may be specified by using an A or B suffix to the port number. The suffix is separated from the port number by a hyphen or slash character. If the suffix is omitted, the A side of the port is used. For example, a port specification of 5-B will use the B side of port number five.

The S command initially loads into the utility command space at \$C100. If sufficient memory has been reserved for the printer driver (see the RM command documentation) it will be relocated there, otherwise it will be relocated into the highest available locations in user memory and the end of user memory pointer will be updated. When the command to be printed has completed any user memory allocated to the printer driver will be released.

The serial data output to the printer is 8-bit ASCII with two stop bits and no parity. The S command does not use an ACK protocol, however it will honor the data terminal ready line if it is connected to the interface.

SAVE

The SAVE command is used for saving a section of memory on the disk. Its primary use is for saving programs which have been loaded into memory from tape or by hand.

DESCRIPTION

The general syntax of the SAVE command is:

```
SAVE,<file spec>,<begin adr>,<end adr>[,<transfer adr>]
```

where <file spec> is the name to be assigned to the file. The default extension is BIN and the default drive is the working drive. The address fields define the beginning and ending addresses of the section of memory to be written on the disk. The addresses should be expressed as hex numbers. The optional <transfer address> would be included if the program is to be loaded and executed by FLEX. This address tells FLEX where execution should begin. Some examples will clarify the use of SAVE:

```
+++SAVE,DATA,100,1FF  
+++SAVE,1.GAME,0,1680,100
```

The first line would SAVE the memory locations 100 to 1FF hex on the disk in a file called DATA.BIN. The file would be put on the working drive and no transfer address would be assigned. The second example would cause the contents of memory locations 0 through 1680 to be SAVED on the disk in file GAME.BIN on drive 1. Since a transfer address of 100 was specified as a parameter, typing 'GAME.BIN' in response to the FLEX prompt after saving would cause the file to be loaded back into memory and execution started at location 100.

If an attempt is made to save a program under a file name that already exists, the prompt "MAY THE EXISTING FILE BE DELETED?" will be displayed. A Y response will replace the file with the new data to be saved while a N response will terminate the save operation.

Sometimes it is desirable to save noncontiguous segments of memory. To do this it would be necessary to first SAVE each segment as a separate file and then use the APPEND command to combine them into one file. If the final file is to have a transfer address, you should assign it to one of the segments as it is being saved. After the APPEND operation, the final file will retain that transfer address.

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SAVE.LOW

There is another form of the SAVE command resident in the UCS. It is called SAVE.LOW and loads in a lower section of memory than the standard SAVE command. Its use is for saving programs in the Utility Command Space where SAVE.CMD is loaded. Those interested in creating their own utility commands should consult the 'Advanced Programmer's Guide' for further details.

SBOX

The SBOX command is used to configure Flex™ to run with various configurations of memory and I/O. The selected configuration is then reported to the programmer.

DESCRIPTION

The general syntax of the SBOX command is:

SBOX [,<parameter>=<value>]

where <parameter> is one of the keywords described below, and <value> is a string appropriate to the keyword. Values are either a decimal number or one of the words "YES" or "NO". If a yes or no response is appropriate, you can specify the single letters "Y" or "N". If no equal sign follows the parameter, an implicit "=Y" is assumed.

The following paragraphs describe each of the keyword parameters and what values they may assume. However, these values are normally set via the Flex™ bootstrap configurator. Using the SBOX command to arbitrarily change these parameters may result in unpredictable results. For example, you can use the SBOX "CPU" parameter to set the "2MHz" bit in the CPU type flag. This does NOT mean that the computer will then be running at 2 MHz. Programs that contain internal timing loops may make use of this flag byte and will then function improperly.

CPU=1 or CPU=2

This parameter is used to set the CPU speed in MHz in the CPU type flag. It is normally used on non-S/09 systems that have been modified to run at 2 Mhz. The flag is set by the bootstrap configurator in S/09 systems.

PORT=4 or PORT=16

This parameter is used to set the number of addresses per I/O port. The default value is set by the configurator and is four for /09 systems only. For S/09, 69/A and 69/K systems, the proper value is sixteen. For compatibility purposes, the keyword "IO=" is also accepted for this parameter.

PLF=50 or PLF=60

This parameter is the Power Line Frequency. It is set by the configurator on S/09 systems only and defaults to 60 Hz. for other computer systems.

EXT=YES or EXT=NO

This value determines whether the system is using extended 20-bit addresses. It is set by the bootstrap if an extended memory unit (such as the Motorola SMS3509) is installed in the computer.

TIMER=YES or TIMER=NO

This parameter is set by the configurator on S/09 systems to reflect the presence of the 68B40 programmable Timer Module on the MP-ID interface. For convenience, the keyword "INT=" (For INTerval timer) is also accepted.

UC=YES or UC=NO

This parameter is defaulted to YES by the bootstrap, and causes Flex™ to internally map all file names into upper case. If both upper and lower case file names are desired, the parameter may be set to "NO".

NOMSG

The final parameter is not a keyword, and may be specified to suppress printing of the option flag settings. This parameter is useful when the SBOX command is included in STARTUP files. When this parameter is not specified, the format of the SBOX report is as follows:

```
SWTPC Configurator -- Version 2
-- Memory Size = 128K
-- I/O Port Size = 16
-- CPU Clock Rate = 2 MHz
-- Power Line Frequency = 60 Hz
-- Extended Addressing = Yes
-- Interval Timer = Yes
-- Real Time Clock = Yes
-- Upper Case Only = Yes
```


SP

The SP command is used to direct the output of commands in the Utility Command set to an IBM Electronic Typewriter Model 50 connected to an MP-WP interface. It is normally used to produce hard copy output from text processors, formatters, and other utility programs.

DESCRIPTION

The general syntax of the SP command is:

SP[#n],<command string>

where #n is optional and is the port number of the MP-WP interface connected to the typewriter and <command string> is a valid command line to be passed to FLEX. If the port number is not specified, it will default to port seven. If the SP command is used with multiple commands per line using the end of line character, it will only affect the command immediately following it in the command line. Some examples will clarify the use of the SP command:

SP,CAT

This example will produce a printed listing of the catalog of the working drive. The port number is omitted and defaults to port seven.

SP#3,LIST,TEXT

This example will produce a printed listing of the file TEXT.TXT. The port has been specified as port number three.

The SP command initially loads into the utility command space at \$C100. If sufficient memory has been reserved for the printer driver (see the RM command documentation) it will be relocated there, otherwise it will be relocated into the highest available locations in user memory and the end of user memory pointer will be updated. When the command to be printed has completed any user memory allocated to the printer driver will be released.

STARTUP

STARTUP is not a utility command but is a feature of FLEX. It is often desirable to have the operating system do some special action or actions upon initialization of the system (during the bootstrap loading process). As an example, the user may always want to use BASIC immediately following the boot process. STARTUP will allow for this without the necessity of calling the BASIC interpreter each time.

DESCRIPTION

FLEX always checks the disk's directory immediately following the system initialization for a file called STARTUP.TXT. If none is found, the three plus sign prompt is output and the system is ready to accept user's commands. If a STARTUP file is present, it is read and interpreted as a single command line and the appropriate actions are performed. As an example, suppose we wanted FLEX to execute BASIC each time the system was booted. First it is necessary to create the STARTUP file:

```
+++BUILD,STARTUP
=BASIC
=#
+++
```

The above procedure using the BUILD command will create the desired file. Note that the file consisted of one line (which is all FLEX reads from the STARTUP file anyway). This line will tell FLEX to load and execute BASIC. Now each time this disk is used to boot the operating system, BASIC will also be loaded and run. Note that this example assumes two things. First, the disk must contain FLEX.SYS and must have been LINKed in order for the boot to work properly. Second, it is assumed that a file called BASIC.CMD actually exists on the disk.

Another example of the use of STARTUP is to set system environment parameters such as TTYSET parameters or the assigning of a system and working drive. If the STARTUP command consisted of the following line:

```
TTYSET,DP=16,WD=60:ASN,W=1:ASN:CAT,0
```

each time the system was booted the following actions would occur. First, TTYSET would set the 'depth' to 16 and the 'width' to 60. Next, assuming the 'end of line' character is the ':', the ASN command would assign the working drive to drive 1. Next ASN would display the assigned system and working drives on the terminal. Finally, a CATalog of the files on drive 0 would be displayed. For details of the actions of the individual commands, refer to their descriptions elsewhere in this manual.

As it stands, it looks as if the STARTUP feature is limited to the execution of a single command line. This is true but there is a way around the restriction, the EXEC command. If a longer list of operations is desired than will fit on one line, simply create a command

file containing all of the commands desired. Then create the STARTUP file placing the single line:

EXEC,<file name>

where <file name> would be replaced by the name assigned to the command file crea A little imagination and experience will show many uses for the STARTUP feature.

By directing STARTUP to a file that does not have a return to DOS command it is possible to lockout access to DOS. You can correct the problem by hitting the RESET button and beginning execution at address SCD03. The STARTUP file may then be deleted and if desired, modified. Directing execution to CD03, the DOS warm start address, bypasses the DOS STARTUP function.

SPF

The SPF (Source Program Filter) command is used to reformat Motorola compatible assembly language source files to be compatible with the SWTPC Optimizing Assembler. The resulting file is in correct format for assembly on the SWTPC 6809 assembler.

DESCRIPTION

The general syntax of the SPF command is:

SPF,<input file>,<output file>

where <input file> is the name of the Motorola compatible source file, and <output file> is the name of the SWTPC source file to be created. The output file must not already exist on disk.

Several syntactic changes are made on the input file. The most obvious change is that the source statement fields are tabbed into proper position for use with the SWTPC editor. Mnemonics carrying separate register designators are condensed into the shortened 6809 format and certain 6800 mnemonics are translated into their equivalent 6809 operations. Motorola-type single character constants are supplied with closing quote characters. Finally, the case of the output file is governed by the case of the output file name. For example, if the output file is named "OUTPUT.TXT", all mnemonics and NON-DATA characters will be forced into upper case ASCII. The case of data-type characters such as those in FCC statements are not changed.

It is important to remember that the Motorola assembler evaluates complex arithmetic expressions in strict left-to-right order while the new SWTPC and TSC assemblers evaluate in priority order. Thus, very complex expressions involving more than two terms and using multiply or divide operators may evaluate differently on the new assemblers. The SPF program DOES NOT alter these expressions and conversion problems may result if such expressions are present in the original Motorola-compatible source.

An example of using the SPF program to reformat an assembler source file is shown below:

```
+++RENAME,SOURCE.TXT,SOURCE.OLD  
+++SPF,SOURCE.OLD,SOURCE.TXT
```

The rename command changes the name of the source file to SOURCE.OLD. This file is then used as input to the SPF program in the second line, to create a reformatted SOURCE.TXT file.

TTYSET

The TTYSET utility command is provided so the user may control the characteristics of the terminal. With this command, the action of the terminal on input and the display format on output may be controlled.

DESCRIPTION

The general syntax of the TTYSET command is:

```
TTYSET[,<parameter list>]
```

where <parameter list> is a list of 2 letter parameter names, each followed by an equals sign ('='), and then by the value being assigned. Each parameter should be separated by a comma or a space. If no parameters are given, the values of all of the TTYSET parameters will be displayed on the terminal.

The default number base for numerical values is the base most appropriate to the parameter. In the descriptions that follow, 'hh' is used for parameters whose default base is hex; 'dd' is used for those whose default base is decimal. Values which should be expressed in hex are displayed in the TTYSET parameter listing preceded by a '\$'. Some examples follow:

```
+++TTYSET
+++TTYSET,DP=16,WD=63
+++TTYSET,BS=8,ES=3
```

The first example simply lists the current values of all TTYSET parameters on the terminal. The next line sets the depth 'DP' to 16 lines and the terminal width, 'WD' to 63 columns. The last example sets the backspace character to the value of hex 8, and the escape character to hex 3.

The following fully describes all of the TTYSET parameters available to the user. Their initial values are defined, as well as any special characteristics they may possess.

BS=hh BackSpace character

This sets the 'backspace' character to the character having the ASCII hex value of hh. This character is initially a 'control H' (hex 08), but may be defined to any ASCII character. The action of the backspace character is to delete the last character typed from the terminal. If two backspace characters are typed, the last two characters will be deleted, etc. Setting BS=0 will disable the backspace feature.

BE=hh Backspace Echo character

This defines the character to be sent to the terminal after a 'backspace' character is received. The character printed will have the ASCII hex value of hh. This character is initially set to a null but can be set to any ASCII character.

The BE command also has a very special use that will be of interest to some terminal owners, such as SWTPC CT-64.

If a hex 08 is specified as the echo character, FLEX will output a space (20) then another 08. This feature is very useful for terminals which decode a hex 08 as a cursor left but which do not erase characters as the cursor is moved.

Example: Say that you mis-typed the word cat as shown below:
+++CAY

typing in one CTRL-H (hex 08) would position the cursor on top of the Y and delete the Y from the DOS input buffer. FLEX would then send out a space (20) to erase the Y and another 08 (cursor left) to re-position the cursor.

DL=hh DeLeTe character

This sets the 'delete current line' character to the hex value hh. This character is initially a 'control X' (hex 18). The action of the delete character is to 'erase' the current input line before it is accepted into the computer for execution. Setting DL=0 will disable the line delete feature.

EL=hh End of Line character

This character is the one used by FLEX to separate multiple commands on one input line. It is initially set to a colon (':'), a hex value of 3A. Setting this character to 0 will disable the multiple command per line capability of FLEX. The parameter 'EL=hh' will set the end of line character to the character having the ASCII hex value of hh. This character must be set to a printable character (control characters not allowed).

DP=dd DePth count

This parameter specifies that a page consists of dd (decimal) physical lines of output. A page may be considered to be the number of lines between the fold if using fan folded paper on a hard copy terminal, or a page may be defined to be the number of lines which can be displayed at any one time on a CRT type terminal. Setting DP=0 will disable the paging (this is the initial value). See EJ and PS below for more details of depth.

WD=dd Width

The WD parameter specifies the (decimal) number of characters to be displayed on a physical line at the terminal (the number of columns). Lines of text longer than the value of width will be 'folded' at every multiple of WD characters. For example, if WD is 50 and a line of 125 characters is to be displayed, the first 50 characters are displayed on a physical line at the terminal, the next 50 characters are displayed on the next physical line, and the last 25 characters are displayed on the third physical line. If WD is set to 0, the width feature will be disabled, and any number of characters will be permitted on a physical line.

NL=dd Null count

This parameter sets the (decimal) number of non-printing (Null) 'pad' characters to be sent to the terminal at the end of each line. These pad characters are used so the terminal carriage has enough time to return to the left margin before the next printable characters are sent. The initial value is 4. Users using CRT type terminals may want to set NL=0 since no pad characters are usually required on this type of terminal.

TB=hh TaB character

The tab character is not used by FLEX but some of the utilities may require one (such as the Text Editing System). This parameter will set the tab character to the character having the ASCII hex value hh. This character should be a printable character.

EJ=dd Eject count

This parameter is used to specify the (decimal) number of 'eject lines' to be sent to the terminal at the bottom of each page. If Pause is 'on', the 'eject sequence' is sent to the terminal after the pause is terminated. If the value dd is zero (which it is by default), no 'eject lines' are issued. An eject line is simply a blank line (line feed) sent to the terminal. This feature is especially useful for terminals with fan fold paper to skip over the fold (see Depth). It may also be useful for certain CRT terminals to be able to erase the previous screen contents at the end of each page.

PS=Y or PS=N PauSe control

This parameter enables (PS=Y) or disables (PS=N) the end-of-page pause feature. If Pause is on and depth is set to some nonzero value, the output display is automatically suspended at the end of each page. The output may be restarted by typing the 'escape' character (see ES description). If pause is disabled, there will be no end-of-page pausing. This feature is useful for those using high-speed CRT terminals

to suspend output long enough to read the page of text.

ES=hh EEscape character

The character whose ASCII hex value is hh is defined to be the 'escape character'. Its initial value is \$1B, the ASCII ESC character. The escape character is used to stop output from being displayed, and once it is stopped, restart it again. It is also used to restart output after Pause has stopped it. As an example, suppose you are LISTing a long text file on the terminal and you wish to temporarily halt the output. Typing the 'escape character' will do this (this feature is not supported on computers using a Control Port for terminal communications). At this time (output halted), typing another 'escape character' will resume output, while typing a RETURN key will cause control to return to FLEX and the three plus sign prompt will be output to the terminal. It should be noted that line output stopping always happens at the end of a line.

TOUCH

The touch command is used to change the last-altered date in a file directory entry to reflect the current date.

DESCRIPTION

The general syntax of the TOUCH command is:

TOUCH,<file spec>

where <file spec> is the name of the file to be touched. If no extension is specified, a default of .TXT is assumed. The directory entry of the file is updated so that the last altered date is set to the current date. The contents of the file itself are not altered.

USEMF

The USEMF command is used to enable access to an MF-68 MiniFloppy disk unit attached to a 6809 computer system with two 8-inch DMAF drives.

DESCRIPTION

The general syntax of the USEMF command is:

USEMF

When the USEMF command is executed, a position independent MF-68 driver is loaded into the utility command space at \$C100. The USEMF program then obtains approximately 330 bytes of memory from the top end of the user memory and relocates the MF-68 driver program into this area. The FLEX® memory end pointer is updated, and the MF-68 driver program is linked into the resident (DMAF) disk drivers. A message is then printed informing the user that the MF-68 drives are now online. The MF-68 drivers will remain resident until the system is re-booted.

Once the USEMF program is executed, any file references with drive specifications of 2 or 3 are directed to MF-68 drives 0 and 1, respectively. The following example shows how USEMF can be used to copy files from a 5-inch diskette to an 8-inch diskette:

USEMF

MF-68 Now Online.

COPY,2,0,.TXT

FILE	STUFF .TXT	TO DRIVE #0	COPIED.
FILE	MORESTUF.TXT	TO DRIVE #0	COPIED.
FILE	STILLMOR.TXT	TO DRIVE #0	COPIED.

etc.

The USEMF command has the following restrictions:

1. The command must not be used when the system has been BOOTED from a 5-inch diskette.
2. The command must not be used more than once between boots. A convenient way to enforce this limitation is to place the command into the startup file.
3. Neither the 5-inch nor the 8-inch NEWDISK command may be run after the USEMF command.

UCAL

The UCAL command is used to enable access to a CalComp Marksman CDS-1 fixed disk unit attached to a 6809 computer system running FLEX9 (Not FLEX9S which includes the CDS-1 drivers) having two 8-inch DMAF drives or two 5-inch MF-68 drives.

DESCRIPTION

The general syntax of the UCAL command is:

UCAL

When the UCAL command is executed, a position independent CalComp Marksman CDS-1 driver is loaded into the utility command space at \$C100. The UCAL program then obtains approximately 280 bytes of memory from the top end of the user memory and relocates the CDS-1 driver program into this area. The FLEX[®] memory end pointer is updated, and the CDS-1 driver program is linked into the resident disk drivers. A message is then printed informing the user that the CDS-1 drive is now online. The CDS-1 drivers will remain resident until the system is re-booted.

Once the UCAL program is executed, any file references with drive specification of 2 is directed to the CDS-1 disk unit. The following example shows how UCAL can be used to copy files from an 8-inch DMAF or 5-inch MF-68 diskette to the CalComp CDS-1 disk unit:

```
+++UCAL
Marksman Now Online.
+++COPY,0,2,.TXT
```

FILE	STUFF .TXT	TO DRIVE #2	COPIED.
FILE	MORESTUF.TXT	TO DRIVE #2	COPIED.
FILE	STILLMOR.TXT	TO DRIVE #2	COPIED.

etc.

The UCAL command has the following restrictions:

1. The command must not be used when the system has been BOOTED with a FLEX9S system already supporting the CalComp drive.
2. The command must not be used more than once between boots. A convenient way to enforce this limitation is to place the command into the startup file.
3. This command must not be used in conjunction with the USEMF command.

VER

The VER command is used to display the version number of a utility or program.

DESCRIPTION

The general syntax of the VER command is:

VER,<file spec>

where <file spec> is the name of the program you wish to check. The default extension is .CMD and the drive defaults to the working drive. As an example:

+++VER,0.CAT

would display the version number of the CAT command (from drive 0) on the terminal.

VERIFY

The VERIFY command is used to set the File Management System's write verify mode. If VERIFY is on, every sector which is written to the disk is read back from the disk for verification (to make sure there are no errors in any sectors). With VERIFY off, no verification is performed.

DESCRIPTION

The general syntax of the VERIFY command is:

```
VERIFY[,ON]  
    or  
VERIFY[,OFF]
```

where ON or OFF sets the VERIFY mode accordingly. If VERIFY is typed without any parameters, the current status of VERIFY will be displayed on the terminal. Example:

```
+++VERIFY,ON  
+++VERIFY
```

The first example sets the VERIFY mode to ON. The second line would display the current status (ON or OFF) of the VERIFY mode. VERIFY causes slower write times, but it is recommended that it be left on for your protection.

WRITPROM

The WRITPROM command is used to write the data contained in a disk file to a 2716 compatible EPROM using a SWTPC MP-R EPROM programmer. WRITPROM first checks the EPROM to be sure that it is erased, writes the data, then verifies the contents.

DESCRIPTION

The general syntax of the WRITPROM command is:

```
WRITPROM[#n],<file spec>,<load address>,[+opt]
```

Where #n is optional and is the port number in which the PROM programmer is installed, <file spec> is the name of the input file, <load address> is the beginning address of the input file that will be written to the EPROM, and [+opt] are the special options (described later) which can be selected. The default extension on the file is .BIN and the default drive is the working drive. The default port for WRITPROM is port #4 and the default file load address is 0000.

Some examples will clarify the syntax of WRITPROM:

```
+++WRITPROM,JUNK
+++WRITPROM #7,JUNK.CMD.1,C800,+R
```

The first example will write the 2K segment starting at address 0000 of the file JUNK.BIN on the working drive to the EPROM on the programmer in port #4. The second example will write the contents of the file JUNK.CMD on drive 1 starting at address C800 to the EPROM on the programmer in port #7 using extended retry capability.

Specifying the Load Address

The load address entered in the command line specifies the beginning address of the 2K byte segment of the file which will be written to the EPROM. As an example say that we want to store the 4K program DIAG.CMD which resides from D000-DFFF into two EPROMs which will be used in some type of ROM board or controller application. The first EPROM should be written by the command WRITPROM,DIAG.CMD,D000. The second EPROM should be written by WRITPROM,DIAG.CMD,D800. If no address is specified, an address of 0000 is assumed. If an address is specified that does not exist in the file, the message "SPECIFIED FILE CONTAINS ALL BYTES = FF" will be displayed when attempting to write the EPROM since no part of the file will be loaded into WRITPROM's write buffer.

Options

R - Retry

Specifying the +R option in the command line will instruct WRITPROM to do multiple re-tries on programming. This feature should only be used when the normal programming sequence fails to program an EPROM correctly.

C - Check +25 volts

The C option is used to turn on the +25 volts on the MP-R board. BE SURE THAT NO EPROM IS INSTALLED WHEN USING THIS OPTION. Entering any character thru the keyboard will turn off the 25 volts and return control to the operating system. To be sure that a file that always exists on the disk is used for the input file, the following sequence should always be used to invoke the C option:

+++WRITPROM,WRITPROM.CMD,+C

Remember that this option is for diagnostic purposes only and is normally not used.

Error Messages

A number of messages can be displayed if an error is encountered during the programming procedure. Most of the messages are self explanatory. If an EPROM which is not completely erased is used, during the "is the EPROM erased" test any bytes that are not erased will be displayed by the message "BYTE AT (ADDRESS) IS (DATA) - CONTINUE?". Entering a Y will cause WRITPROM to check the next byte. Entering a B will cause the rest of the "is the EPROM erased" check to be bypassed and an N will cause the programming sequence to terminate. When verifying the contents of the EPROM after writing, a similar output is generated for those bytes which did not program correctly. Again the verification can continue by typing Y, be bypassed by typing B or exited by typing N.

If the message "SPECIFIED FILE CONTAINS ALL BYTES = FF" is ever displayed then either the specified input file contains only \$FF's as data or an incorrect load address was entered.

The EPROM should not be installed in the programmer until WRITPROM tells you to do so.

Default Port Addresses

If desired, the default port addresses can be changed by using the Flx utility on WRITPROM.CMD.

WRITPROM Address	Contents
1000	S/09, 69A, 69K Default Port Address
1002	/09 Default Port Address

XOUT

XOUT is a special form of the delete command which deletes all files having the extension .OUT.

DESCRIPTION The general syntax of XOUT is:

XOUT[,<drive spec>]

where <drive spec> is the desired drive number. If no drive is specified all, .OUT files on the working drive will be deleted and if auto drive searching is enabled, all .OUT files on drives 1 and 2 will be deleted. XOUT will not delete any files which are delete protected or which are currently in the print queue.

Example:

+++XOUT

+++XOUT 1

The Y command is used to automatically answer "Y" to prompts produced by various FLEX utilities. This facility is especially useful when writing EXEC files.

DESCRIPTION

The general syntax of the Y command is:

Y,<command string>

where <command string> is a valid command line to be passed to FLEX. If the Y command is used with multiple commands per line using the end of line character, it will only affect the command immediately following it. Some examples will show the usefulness of the Y command:

```
+++Y,DELETE,JUNK.TXT
DELETE "O.JUNK.TXT" ? Y
ARE YOU SURE? Y
```

This example shows how to delete a file without having to reply to the "ARE YOU SURE?" prompt. This is especially useful in EXEC files. In a similar vein, you can perform COPY commands that automatically overwrite existing files, as shown in the following example:

```
+++Y,COPY,0,1,PROG

FILE  PROG1  .TXT  TO DRIVE #1  COPIED.
FILE  PROG2  .TXT  TO DRIVE #1  FILE EXISTS
      DELETE ORIGINAL? Y
      ARE YOU SURE? Y      COPIED.
FILE  PROG3  .TXT  TO DRIVE #1  FILE EXISTS
      DELETE ORIGINAL? Y
      ARE YOU SURE? Y      COPIED.
```


GENERAL SYSTEM INFORMATION

I. DISK CAPACITY

Each sector of a FLEX diskette contains 252 bytes of user data since 4 bytes of each 256 byte sector is used by the system. The various capacities of disks are as follows:

5-inch Single Sided	340 sectors, 85,680 bytes
5-inch Double Sided	680 sectors, 171,360 bytes
8-inch Single Sided, Single Density	1140 sectors, 287,280 bytes
8-inch Single Sided, Double Density	1976 sectors, 497,952 bytes
8-inch Double Sided, Single Density	2280 sectors, 574,560 bytes
8-inch Double Sided, Double Density	3952 sectors, 995,904 bytes

II. WRITE PROTECT

Floppy disks can normally be physically write protected to prevent FLEX from performing a write operation. Any attempt to write to such a disk will cause an error message to be issued. It is good practice to write protect disks which have important files on them.

A 5-inch disk can be write protected by placing a piece of opaque tape over the small rectangular cutout on the edge of the disk. 8-inch disks are the opposite, i.e., in order to write on a full size disk, you must place tape over the notch on the rear edge of the diskette. To write protect them, remove the tape. Some 8-inch disks do not have a write protect notch and cannot be write protected.

III. THE 'RESET' BUTTON

The RESET button on the front panel of your computer should NEVER BE PRESSED DURING A DISK OPERATION. There should never be a need to 'reset' the machine while in FLEX. If the machine is 'reset' and the system is writing data on the disk, it is possible that the entire disk will become damaged. Again, never press 'reset' while the disk is operating! Refer to the 'escape' character in TTYSET for ways of stopping FLEX.

IV. NOTES ON THE P COMMAND

The various printer commands initially load into the utility command space at \$C100. A check is then made for a reserved printer driver area (See the RM command) and if available, the printer driver is relocated there. If there is no reserved printer area, the printer drivers are relocated into the high end of user memory and the end of user memory pointer is updated. When the command to be printed completes, the memory occupied by the printer driver is returned to the user memory area.

V. ACCESSING DRIVES NOT CONTAINING A DISKETTE

If an attempt is made to access a drive not containing a disk, an error message is normally issued. However, if you are using 5-inch disks and a DC-1 or DC-2 controller, the system will hang up attempting to read until a disk is inserted and the door closed.

VI. SYSTEM ERROR NUMBERS

Any time that FLEX detects an error during an operation, an appropriate error message will be displayed on the terminal. FLEX internally translates a derived error number into a plain language statement using a look-up file called ERROR.SYS. If you have forgotten to copy this .SYS file onto a disk that you are using, FLEX will report a corresponding number as shown below:

DISK ERROR #xx

where 'xx' is a decimal error number. The table below is a list of these numbers and what error they represent.

ERROR #	MEANING
1	ILLEGAL FMA FUNCTION CODE ENCOUNTERED
2	THE REQUESTED FILE IS IN USE
3	THE FILE SPECIFIED ALREADY EXISTS
4	THE SPECIFIED FILE COULD NOT BE FOUND
5	SYSTEM DIRECTORY ERROR-REBOOT SYSTEM
6	THE SYSTEM DIRECTORY IS FULL
7	ALL AVAILABLE DISK SPACE HAS BEEN USED
8	READ PAST END OF FILE
9	DISK FILE READ ERROR
10	DISK FILE WRITE ERROR
11	THE FILE OR DISK IS WRITE PROTECTED
12	THE FILE IS PROTECTED-FILE NOT DELETED
13	ILLEGAL FILE CONTROL BLOCK SPECIFIED
14	ILLEGAL DISK ADDRESS ENCOUNTERED
15	AN ILLEGAL DRIVE NUMBER WAS SPECIFIED
16	DRIVE NOT READY
17	THE FILE IS PROTECTED-ACCESS DENIED
18	SYSTEM FILE STATUS ERROR
19	FMS DATA INDEX RANGE ERROR
20	FMS INACTIVE-REBOOT SYSTEM
21	ILLEGAL FILE SPECIFICATION
22	SYSTEM FILE CLOSE ERROR
23	SECTOR MAP OVERFLOW-DISK TOO SEGMENTED
24	NON-EXISTENT RECORD NUMBER SPECIFIED
25	RECORD NUMBER MATCH ERROR-FILE DAMAGED
26	COMMAND SYNTAX ERROR-RE-TYPE COMMAND
27	THAT COMMAND IS NOT ALLOWED WHILE PRINTING
28	WRONG HARDWARE CONFIGURATION

VII. SYSTEM MEMORY MAP

The following is a brief list of the RAM space required by the FLEX Operating System. All address are in hex.

0000 - BFFF	User RAM *Note: Some of this space is used by NEWDISK, COPY, and the printer utilities.
C000 - C07F	System Stack
C080 - C0FF	Line Input Buffer
C100 - C6FF	Utility command space
C700 - DFFF	Disk Operating System
CD00	FLEX cold start entry address
CD03	FLEX warm start entry address

For a more detailed memory map, consult the 'Advanced Programmer's Guide'.

VIII. FLEX OPERATING SYSTEM INPUT/OUTPUT SUBROUTINES

In order for the FLEX I/O functions to operate properly, all user program character input/output subroutines should be vectored thru the FLEX operating system rather than the computer's monitor. Below is a list of FLEX's I/O subroutines and a brief description of each. All given addresses are in hexadecimal.

GETCHR at \$CD15

This subroutine is functionally equivalent to S-BUG's character input routine. This routine will look for one character from the control terminal (I/O port #1) and store it in the A accumulator. Once called, the input routine will loop within itself until a character has been input. Anytime input is desired, the call JSR GETCHR or JSR \$CD15 should be used.

GETCHR automatically sets the 8th bit to 0 and does not check for parity. A call to this subroutine affects the processor's registers as follows:

ACC. A loaded with the character input from the terminal
B,X,Y,U not affected

PUTCHR at \$CD18

This subroutine is used to output one character from the computer to the control port (I/O port #1). It is functionally equivalent to the output character routine in S-BUG.

To use PUTCHR, the character to be output should be placed in the A accumulator in its ASCII form. For example, to output the letter 'A' on the control terminal, the following program should be used:

```
LDA    #$41
JSR    $CD18
```

The processor's registers are affected as follows:

ACC. A changed internally
B,X,Y,U not affected

PSTRNG at \$CD1E

PSTRNG is a subroutine used to output a string of text on the control terminal. When address \$CD1E is called, a carriage return and line feed will automatically be generated and data output will begin at the location pointed to by the index register. Output will continue until a hex 04 is seen. The same rules for using the ESCAPE and RETURN keys for stopping output apply as described earlier.

The accumulator and register status after using PSTRNG are as follows:

ACC. A Changed during the operation

ACC. B	Unchanged
X	Contains the memory location of the last character read from the string (usually the 04 unless stopped by the ESC key)
Y,U	Unchanged

NOTE: The ability of using backspace and line delete characters is a function of your user program and not of the FLEX I/O routines described above.

STAT at \$CD4E

This routine is used to determine the "status" of the input device. That is, to see if a character has been typed on the input terminal keyboard. Its function is to check for characters such as the ESCAPE key in FLEX which allows breaking of the output. This routine returns an EQUAL condition if no character was hit and a Not-Equal condition if a character was hit. No registers, except for the condition codes, may be altered.

For additional information consult the 'Advanced Programmer's Manual'.

IX. BOOTING THE FLEX DISK OPERATING SYSTEM

In order to read FLEX from the system disk upon powering up your system, you must have a short program in RAM or ROM memory. This program is called a 'bootstrap' loader.

If you are using a Southwest Technical Products disk system and the S-BUG monitor, there are bootstraps stored in this ROM which you can use. They are executed by simply typing a 'D' for the full size floppy or a 'U' for the mini floppy.

Those users of other hardware or monitor ROM should use the boot supplied with the hardware if compatible with FLEX. A sample boot (for the SWTPc mini system) is given here for reference.

If the system does not boot properly, re-position the system disk in the drive and re-execute the bootstrap loader.

0100 B6	E018	START	LDA	COMREG	TURN MOTOR ON
0103 86	00		LDA	#0	
0105 B7	E014		STA	DRVREG	
0108 8E	0000		LDX	#0000	
010B 3D		OVR	MUL		DELAY FOR SPEED UP
010C 30	1F		LEAX	-1,X	
010E 26	FB		BNE	OVR	
0110 C6	0F		LDB	#\$0F	RESTORE
0112 F7	E018		STB	COMREG	
0115 8D	2B		BSR	RETURN	
0117 F6	E018	LOOP1	LDB	COMREG	
011A C5	01		BITB	#1	
011C 26	F9		BNE	LOOP1	
011E 86	01		LDA	#1	
0120 B7	E01A		STA	SECREG	
0123 8D	1D		BSR	RETURN	
0125 C6	8C		LDB	#\$8C	READ WITH LOAD
0127 F7	E018		STB	COMREG	
012A 8D	16		BSR	RETURN	
012C 8E	C000		LDX	#\$C000	
012F C5	02	LOOP2	BITB	#2	DRQ?
0131 27	05		BEQ	LOOP3	
0133 B6	E01B		LDA	DATREG	
0136 A7	80		STA	0,X+	
0138 F6	E018	LOOP3	LDB	COMREG	
013B C5	01		BITB	#1	BUSY?
013D 26	F0		BNE	LOOP2	
013F 7E	C000		JMP	#\$C000	
0142 8D	00	RETURN	BSR	RTN	
0144 39		RTN	RTS		

X. REQUIREMENTS FOR RELOCATABLE PRINTER DRIVERS

There are four routines that must be furnished in all printer drivers --

- 1) An OPEN routine which is called to perform all necessary printer initialization,
- 2) A CLOSE routine which is called to perform all necessary printer cleanup and termination operations,
- 3) A PUT routine which is called to output the next character to the printer, and
- 4) A CHECK routine which is called to determine if the printer is ready to accept another character.

The assembled printer driver which contains these routines is then combined with the "P.COR" binary file furnished with the operating system. For the procedure used to combine these two files see the documentation on P.COR, section P.2.

All four of the required routines may be located anywhere in the space provided for the routines (C312-C6FF hex). The only requirement is that one of the long branch (LBRA) instructions in the entry point vector (located at C302-C30D hex) will branch to the appropriate routine. All four routines must end with a return from subroutine (RTS) instruction. All four routines must preserve the contents of the Y and U registers.

The OPEN and CLOSE routines have no input or output parameterization, but must preserve the contents of the Y and U registers. The PUT routine expects the character to be output in the A register on entry to the routine, while the B, X, Y and U registers must be preserved. The CHECK must return a minus indication if the printer is ready to accept another character, otherwise it must return a plus indication. The contents of all of the registers must be preserved by the CHECK routine.

Since the printer driver will be relocated from the \$C300 location where it is assembled, the driver must be written in position independent code. Two good examples of position independent code are the parallel printer driver and the serial printer driver listed in chapter 3, section XI of this manual. The following are good rules of thumb that may be used while writing position independent code.

- 1) If an instruction that will be relocated needs to reference a byte of data that will be relocated as well, "program counter relative" addressing must be used. All this means is that a ",PCR" must be added to the instruction. As an example refer to both the position independent parallel printer driver listed in section XI of chapter 3 and the non position independent parallel printer driver listed in section XII of chapter 3. Look at the references to variable "PFLAG". "COM PFLAG" is not position independent, while "COM PFLAG,PCR" is.

- 2) If the location referenced by a JMP or JSR instruction will be relocated, do not use JMP or JSR; use BRA, BSR, LBRA or LBSR instead.
- 3) It is okay to use any of the "indexed" addressing modes in position independent code. Instructions that make use of "indexed" addressing may have operands that look like any of the following: 0,X or 5,X or 0,Y and so on.
- 4) It is okay to use the "immediate" addressing mode in position independent code. An immediate value is one preceded by the number sign character (#).

The following table describes the location where all items of the printer driver must be assembled.

C300 - C301	Two byte count of the number of bytes in the driver. This count includes all of the bytes between C302 and the end of the driver.		
C302 - C304	LBRA	OPEN	PRINTER INITIALIZE
C305 - C307	LBRA	CLOSE	PRINTER TERMINATE
C308 - C30A	LBRA	PUT	PRINT CHARACTER
C30B - C30D	LBRA	CHECK	PRINTER READY CHECK
C30E - C30F	Port address of the printer interface. The default port address should be assembled into these locations. If a port number is supplied on the command line, a new port address will be stored here by the P.COR processing.		
C310	Interface Side designator. If a "side" is specified in the command port specification, the sign bit of this byte is set. A side specification of "A" will result in \$80, "B" will be \$81, etc.		
C311	Reserved byte - assemble a zero into this location.		
C312 - C6FF	Space for printer driver routines. These routines must fit within the space provided. The entire space does not need to be used.		

XI. PARALLEL AND SERIAL PRINT DRIVERS

The following parallel and serial print drivers are provided to assist the programmer in the creation of position independant relocatable print drivers for use with the P.COR file. The parallel driver assumes a parallel port having an address of \$E01C which is the default address for port seven in a /09 computer system. It makes use of the CENTRONIX® handshake, and (although position independant) is essentially equivalent to the non-relocatable driver listed in section XII. The serial driver assumes an acia at address \$E01C (also defaulting to port 7) and transmits with 8 data bits, no parity, and two stop bits. The baud rate is set at the interface.

By comparing the position independant and non-relocatable parallel print drivers, it will be simple to write your own custom printer drivers. Just remember to use program counter relative addressing for all variables defined within the printer driver itself.


```

*
* THE FOLLOWING PRINTER DRIVER WAS WRITTEN
* IN POSITION INDEPENDANT CODE AND IS
* DESIGNED TO BE APPENDED TO THE P.COR
* FILE TO MAKE A PRINTER COMMAND
*
*
* SET UP ADDRESSES AND DRIVER LENGTH
*
C300                                ORG    $C300    MUST START AT C300
C300 0050                          FDB    ENDS-POPEN LENGTH OF DRIVER
*
* ENTRY VECTORS
*
C302 16 000E  POPEN  LBRA  OPEN    PRINTER INITIALIZE
C305 16 001B  PQUIT  LBRA  CLOSE   PRINTER TERMINATE
C308 16 001A  PCHAR  LBRA  PUT     PRINT CHARACTER
C30B 16 002F  PCHEK  LBRA  CHECK   PRINTER READY CHECK
*
* PARALLEL PRINTER FILE CONTROL BLOCK
*
C30E E01C  PIA    FDB    $E01C    DEFAULT PORT ADDRESS
C310 00    SIDE   FCB    0        INTERFACE SIDE VALUE
C311 00    FCB    0        -- RESERVED BYTE --
C312 FF    PFLAG  FCB    $FF     PRINTER READY FLAG

0000      DR     EQU    0        DATA REGISTER OF PIA
0000      DDR    EQU    0        DATA DIRECTION REG OF PIA
0001      CR     EQU    1        CONTROL REGISTER OF PIA
*
* PRINTER INITIALIZATION
*
C313 AE 8C F8  OPEN  LDX    PIA,PCR  PICK UP PIA ADDRESS
C316 86 3A     LDA    #$3A    SELECT DATA DIRECTION REG
C318 A7 01     STA    CR,X    BY WRITING 0 IN DDR CONTROL
C31A 86 FF     LDA    #$FF    SELECT ALL OUTPUT LINES
C31C A7 84     STA    DDR,X   PUT IN DATA DIRECTION REG
C31E 86 3E     LDA    #$3E    SET UP FOR TRANSITION CHECKS
C320 A7 01     STA    CR,X    AND ENABLE OUTPUT REGISTER
C322 39      RTS

*
* TERMINATE PRINTER PROCESSING
*
C323 86 0D     CLOSE  LDA    #$0D    PRINT CARRIAGE RETURN

```


PARALLEL PRINTER DRIVER

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*
* PRINTER OUTPUT CHARACTER ROUTINE
*

C325	8D	16	PUT	BSR	CHECK	TEST FOR PRINTER READY
C327	2A	FC		BPL	PUT	LOOP UNTIL PRINTER READY
C329	34	10		PSHS	X	SAVE INDEX REGISTER
C32B	6F	8C E4		CLR	PFLAG,PCR	SET PRINTER FLAG NOT READY
C32E	AE	8C DD		LDX	PIA,PCR	GET PRINTER ADDRESS
C331	A7	84		STA	DR,X	SET DATA IN OUTPUT REGISTER
C333	86	36		LDA	#\$36	SET DATA READY, HIGH TO LOW
C335	A7	01		STA	CR,X	STORE IN CONTROL REGISTER
C337	86	3E		LDA	#\$3E	THEN SEARCH FOR TRANSITION
C339	A7	01		STA	CR,X	OF LOW LEVEL TO HIGH LEVEL
C33B	35	90		PULS	X,PC	

*
* CHECK FOR PRINTER READY
*

C33D	34	10	CHECK	PSHS	X	SAVE INDEX REGISTER
C33F	6D	8C D0		TST	PFLAG,PCR	CHECK READY FLAG
C342	2B	0C		BMI	CHEXIT	IF NEGATIVE, PRINTER READY
C344	AE	8C C7		LDX	PIA,PCR	PICK UP INTERFACE ADDRESS
C347	6D	01		TST	CR,X	CHECK FOR TRANSITION
C349	2A	05		BPL	CHEXIT	IF PLUS, PRINTER NOT READY
C34B	6D	84		TST	DR,X	RESET TRANSITION STATUS
C34D	63	8C C2		COM	PFLAG,PCR	SET PRINTER READY FLAG
C350	35	90	CHEXIT	PULS	X,PC	
C352			ENDS	EQU	*	END OF DRIVER
				END		

0 ERROR(S) DETECTED

C300 0044 FDB ENDS-POPEN LENGTH OF DRIVER

C302	16	000D	POPEN	LBRA	OPEN	PRINTER INITIALIZE
C305	16	0025	PQUIT	LBRA	CLOSE	PRINTER TERMINATE
C308	16	0024	PCHAR	LBRA	PUT	PRINT CHARACTER
C30B	16	002E	PCHEK	LBRA	CHECK	PRINTER READY CHECK

C30E E01C	ACIA	FDB	\$E01C	DEFAULT PORT ADDRESS
C310 00	SIDE	FCB	0	INTERFACE SIDE VALUE
C311 00		FCB	0	-- RESERVED BYTE --

```

C312 A6      8C FB      OPEN      LDA      SIDE,PCR
C315 2A      08          BPL      ARESET      IF POSITIVE NO SIDE SPECIFIED
C317 48          ASLA
C318 48          ASLA      MULTIPLY BY FOUR
C319 AB      8C F3      ADDA      ACIA+1,PCR
C31C A7      8C F0      STA      ACIA+1,PCR STORE INTO DEVICE ADDRESS

```

```

C31F AE      8C EC      ARESET LDX      ACIA,PCR  GET ACIA ADDRESS
C322 86      03                LDA      #%00000011
C324 A7      84                STA      0,X          DO MASTER RESET ON ACIA
C326 86      11                LDA      #%00010001
C328 A7      84                STA      0,X          SET UP NO PARITY BIT,
C32A 6D      01                TST      1,X          8 DATA BITS, 2 STOP BITS
C32C 39                RTS

```

C32D 86 OD CLOSE LDA #SOD SEND OUT CARRIAGE RETURN

C32F	8D	0B	PUT	BSR	CHECK	WAIT FOR PRINTER READY
C331	2A	FC		BPL	PUT	
C333	34	10		PSHS	X	
C335	AE	8C D6		LDX	ACIA,PCR	GET ACIA ADDRESS
C338	A7	01		STA	1,X	STORE INTO DATA REGISTER
C33A	35	90		PULS	X,PC	

SERIAL PRINTER DRIVER

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* CHECK TO SEE IF PRINTER IS READY

C33C	34	04	CHECK	PSHS	B	
C33E	E6	9C CD		LDB	[ACIA,PCR]	GET ACIA STATUS
C341	56			RORB		
C342	56			RORB		SHIFT READY BIT
C343	56			RORB		INTO SIGN FLAG
C344	35	84		PULS	B,PC	
C346			ENDS	EQU	*	END OF DRIVER
				END		

0 ERROR(S) DETECTED

XII. FORMER P AND PRINT.SYS

FLEX, as originally supplied, included a printer driver that will work with most parallel type printers, such as the SWTPC PR-40. Although this printer driver has been superseded, a source listing has been included for compatibility purposes. If desired, these drivers may be used with the PO print command. The requirements for this type of driver are as follows:

- 1) The driver must be in a file called PRINT.SYS
- 2) Three separate routines must be supplied, a printer initialization routine (PINIT at \$CCCC), a check ready routine (PCHK at \$CCD8), and an output character routine (POUT at \$CCE4).
- 3) When the POUT routine is called by FLEX, the character to be output will be in the A accumulator. The output routine must not destroy the B, X, Y, or U registers. PINIT may destroy the A, B, and X registers. PCHK may not alter any registers.
- 4) The routines MUST start at the addresses specified, but may be continued anywhere in memory if there is not room where specified. If placed elsewhere in memory, be certain they do not conflict with any utilities or programs which will use them.
- 5) All three routines must end with a return from subroutine (RTS) instruction.

*
* PRINT.SYS PIA DRIVERS FOR GENERAL CASE PRINTER
*

E01C PIA EQU \$E01C PIA ADDRESS FOR PORT #7

*
* PRINTER INITIALIZATION (MUST BE AT \$CCCC)
*

CCCC		ORG	\$CCCC	MUST RESIDE AT \$CCCC
CCC0 86	3A	PINIT	LDA #\$3A	SELECT DATA DIRECTION REG.
CCC2 B7	E01D		STA PIA+1	BY WRITING 0 IN DDR CONTROL
CCC5 86	FF		LDA #\$FF	SELECT ALL OUTPUT LINES
CCC7 B7	E01C		STA PIA	PUT IN DATA DIRECTION REG.
CCCA 86	3E		LDA #\$3E	SET UP FOR TRANSITION CHECKS
CCCC B7	E01D		STA PIA+1	AND ENABLE OUTPUT REGISTER
CCCF 39			RTS	


```

*
* PRINTER READY ROUTINE
*
CCD0 7D   E01C   PREADY TST   PIA      RESET PIA READY INDICATION
CCD3 73   CCE3       COM   PFLAG    SET THE PRINTER READY FLAG
CCD6 39              RTS
*
* CHECK FOR PRINTER READY (MUST BE AT $CCD8)
*
CCD8              ORG   $CCD8   PRINT TEST AT $CCD8
CCD8 7D   CCE3   PCHK  TST   PFLAG TEST FOR PRINTER READY
CCDB 2B   05       BMI   PCHKX  IF NEGATIVE, PRINTER READY
CCDD 7D   E01D       TST   PIA+1 CHECK FOR TRANSITION
CCE0 2B   EE       BMI   PREADY IF MINUS, PRINTER NOW READY
CCE2 39       PCHKX  RTS
*
* PRINTER READY FLAG
*
CCE3 FF       PFLAG  FCB   $FF    PRINTER READY FLAG
*
* PRINTER OUTPUT CHARACTER ROUTINE (MUST BE AT $CCE4)
*
CCE4              ORG   $CCE4   MUST RESIDE AT $CCE4
CCE4 8D   F2       POUT  BSR   PCHK  TEST FOR PRINTER READY
CCE6 2A   FC       BPL   POUT   LOOP UNTIL PRINTER READY
CCE8 7F   CCE3     CLR   PFLAG  SET PRINTER FLAG NOT READY
CCEB B7   E01C     STA   PIA    SET DATA IN OUTPUT REGISTER
CCEE 86   36       LDA   #$36   SET DATA READY, HIGH TO LOW
CCF0 8D   02       BSR   POUTB  STUFF BYTE INTO THE PIA
CCF2 86   3E       LDA   #$3E   THEN SEARCH FOR TRANSITION
CCF4 B7   E01D     POUTB  STA   PIA+1 OF LOW LEVEL TO HIGH LEVEL
CCF7 39              RTS
*
END

```

This mechanism for creating printer drivers is adequate for those drivers that will fit entirely within the printer driver area located from \$CCCC0 to \$CCF7. For those drivers that require additional memory, it is recommended that the P.COR program be used with position independant printer drivers.

COMMAND SUMMARY

APPEND,<file spec>[,<file list>],<file spec>

Default extension: .TXT

Description page: A.1

ASN[,W=<drive>][,S=<drive>]

Description page: A.2

BUILD,<file spec>

Default extension: .TXT

Description page: B.1

CAT[,<drive list>][,<match list>]

Description page: C.1

COPY,<file spec>,<file spec>

COPY,<file spec>,<drive>

COPY,<drive>,<drive>[,<match list>]

Description page: C.2

C4MAT

Description page: C.3

DATE[,<dd,mm.yy>]

Description page: D.1

DELETE,<file spec>[,<file list>]

Description page: D.2

EC,<string>

Description page: E.1

EXEC,<file spec>

Default extension: .TXT

Description page: E.2

FIX,<file spec>

Default extension: .BIN

Description page: F.1

GET,<file spec>[,<file list>]

Default extension: .BIN

Description page: 1.7

I,<file spec>,<command>

Default extension: .TXT

Description page: I.1

JUMP,<hex address>

Description page: J.1

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LINK,<file spec>

Default extension: .SYS

Description page: L.1

LIST,<file spec>L,<line range>]L,NJ

Default extension: .TXT

Description page: L.2

MON

Description page: 1.7

NEWDISK,<drive>

Description page: N.1

N,<command string>

Description page: N.2

O,<file spec>,<command>

Default extension: .OUT

Description page: O.1

P,<command>

Description page: P.1

P.COR

Description page: P.2

PO,<command>

Description page: P.3

PSP,[<spool file>] L,<print command>] L,<repeat count>]

Description page: P.4

PROT,<file spec>L,(options)]

Description page: P.5

READPROM[#n], <file spec>

Description page: R.3

Q,<command>

Description page: Q.1

QCHECK

Description page: Q.2

RENAME,<file spec 1>,<file spec 2>

Default extension: .TXT

Description page: R.1

RM[,<size>]

Description page: R.2

S,<command>
Description page: S.1

SAVE,<file spec>,<begin adr>,<end adr>[,<transfer adr>]
Default extension: .BIN
Description page: S.2

SAVE.LOW
Description page: S.2.2

SBOX[,IO=<#n>]
Description page: S.3

SP,<command>
Description page: S.4

STARTUP
Description page: S.5

TTYSET[,<parameter list>]
Description page: T.1

TOUCH,<file spec>
Description page: T.2

USEMF
Description page: U.1

UCAL
Description page: U.2

VER
Default Extension: .CMD
Description page: V.1

VERIFY[,<ON or OFF>]
Description page: V.2

WKITPROML#n],<file spec>,<load address>,[+opt]
Description page: W.1

XOUT[,<drive spec>]
Description page: X.1

Y,<command string>
Description page: Y.1